Supportive Care in Cancer (2019) 27:951–958
https://doi.org/10.1007/s00520-018-4384-x

ORIGINAL ARTICLE

Implementing and sustaining an evidence-based nutrition service in a haematology unit for autologous stem cell transplant patients

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Received: 14 February 2018 / Accepted: 26 July 2018 / Published online: 2 August 2018

Abstract

Purpose Effective, timely and evidence-based nutritional management is important in patients receiving autologous haematopoietic stem cell transplant (HSCT) to prevent the negative consequences of developing malnutrition. This study describes a robust process for development and implementation of an evidence-based nutrition care pathway for HSCT patients in a tertiary cancer centre.

Methods A comprehensive review of the literature was completed to identify relevant articles and evidence-based guidelines to inform the development of the pathway. Evidence from the literature review was assessed and utilised to underpin the development of pathway. The pathway was implemented in the haematology service in collaboration with the multidisciplinary haematology team. Dietetic resource requirements for implementation of the pathway were determined and clinician compliance with the care pathway was assessed to evaluate the feasibility of the pathway in supporting delivery of evidence-based care.

Results The evidence-based care pathway was implemented in 2011 with the final care pathway based on recommendations from five international evidence-based guidelines. Overall clinician compliance with delivering nutrition management described in the care pathway was high at 84%. The dietetic resource requirement for implementation of the care pathway was 300 to 400 h per 100 patients depending on conditioning chemotherapy regimen.

Conclusion A robust process for developing and implementing a nutrition care pathway for HSCT patients was effective in supporting the delivery of evidence-based nutritional management for patients treated with HSCT.

Keywords Nutrition · Haematology · Autologous stem cell transplant · Care pathway

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Introduction

Haematological malignancies are types of cancer originating in the blood, bone marrow or lymphatic tissues. Leukaemia, lymphoma, myeloma comprise the majority of haematological malignancies with 918,000 new cases globally in 2012 accounting for 6.5% of all cancers [1]. Autologous haemopoietic stem cell transplant (HSCT) is one form of treatment for haematological malignancies and involves high dose ablative conditioning chemotherapy followed by intravenous reinfusion of the recipient's previously harvested stem cells. Over 1700 stem cell transplants are carried out in Australia each year and over two thirds of these are autologous transplants [2].

Gastrointestinal toxicity, in the form of mucositis, diarrhoea, nausea and vomiting, is common after autologous HSCT [3, 4]. These toxicities, in combination with the catabolic state induced by the conditioning chemotherapy and

post-transplant infection, often result in suboptimal nutrition intake [3, 4]. Consequently malnutrition is common within this patient group with studies reporting a prevalence of 34% malnutrition in haematological patients generally [5, 6], and a similar proportion of 35% develop malnutrition following treatment with autologous HSCT [7]. A small study of 24 autologous HSCT recipients demonstrated significant deterioration in nutritional status, loss of lean body mass, and reduced quality of life over the duration of admission for HSCT, whilst the loss in lean body mass was sustained at 100 days post HSCT [7]. Malnutrition is associated with a longer length of post-HSCT hospital stay and is an established independent risk factor for mortality after HSCT [8–10].

Effective, evidence-based and timely nutritional support therefore has an important role in optimising HSCT outcomes [10, 11]. Nutrition support has been shown to reduce malnutrition and associated consequences on outcomes in patients undergoing HSCT [10]. A recent study by Andersen et al. demonstrated the positive effect of implementing a standardised nutrition support pathway on timely and appropriate nutritional intervention and feeding practises in patients receiving HSCT [11].

Care pathways are designed to guide consistency in the complex care needs of a defined population over a predetermined period of time or treatment course. They are a form of implementation research to support standardisation of care, reduce variation in practice and support the translation of recommendations from evidence-based guidelines into local protocols for improved patient care [12]. The implementation of nutrition care pathways has been shown to improve nutrition outcomes, reduce hospital admissions, improve treatment completion and support the more appropriate use of nutrition intervention across a number of oncology settings [11, 13–16]. Whilst a previous study has investigated the benefits of implementing a nutrition care pathways for HSCT on patient outcomes, the process of pathway development, implementation, sustainability and the organisational resource requirements have not previously been well described.

The aim of this study was to describe the development of an evidence-based care pathway for the nutritional management of patients undergoing autologous HSCT, determine the resource requirements for implementation and assess clinician compliance with the pathway.

Methods

Study setting

Peter MacCallum Cancer Centre is a tertiary cancer centre treating approximately 100 autologous HSCT patients per year. The multidisciplinary team managing this patient cohort consists of haematologists, nurses, dietitians, pharmacists, social workers, occupational therapists, physiotherapists, exercise physiologists, psychologists, radiation oncologists and radiation therapists. Treatment of HSCT occurs in the inpatient setting with ambulatory follow-up often required to facilitate rehabilitation. This study was completed as a quality improvement project with all data collected within usual care and therefore did not require approval from the centre's ethics committee. Prior to development and implementation of the care pathway, nutritional care was provided to HSCT population based on clinical judgement with no standardisation of care.

Literature review

A comprehensive review of the literature was undertaken to identify relevant studies and evidence-based guidelines up to May 2010. The following databases were searched: MEDLINE, PubMed, Embase, CINAHL and Cochrane database. Search terms and mesh heading included: haematological cancer/malignancy, stem cell transplant, nutrition/malnutrition/diet/nutrition support/enteral feeding/parenteral feeding/neutropenia/food safety. Searches were restricted to English language and human subjects. Abstracts were reviewed to determine relevant articles, for which full text articles were sourced, critically appraised and graded according to National Health and Medical Research Council (NHMRC) level of evidence [17]. Preference was given to systematic reviews and randomised trials as the highest levels of evidence.

Care pathway development

The framework used for the development of the care pathway was the Nutrition Care Process (NCP), developed by the Academy of Nutrition and Dietetics and adopted by the Dietitians Association of Australia [18, 19]. The NCP contains the four key steps in a dietetic consultation: (1) nutrition assessment, (2) nutrition diagnosis, (3) nutrition intervention and (4) nutrition monitoring and evaluation. The care pathway was intended to describe care more broadly than the dietetic consultation and therefore the NCP framework was adapted to include the following components for the care pathway: (1) nutrition screening, (2) timing of initial dietetic contact, (3) nutrition diagnosis and assessment, (4) nutrition intervention, (5) frequency of dietetic review and (6) follow-up. Articles identified in the literature review were reviewed to determine the evidence for each element of the care pathway. The care pathway was distributed to members of the haematology multidisciplinary team (MDT) for consultation and feedback. Revision of the pathway incorporating feedback was undertaken until professional consensus was achieved.

Care pathway implementation and sustainability

Relevant stakeholders, including medical, nursing, and allied health professionals, were consulted and education provided on the process of implementing the nutrition care pathway and required modifications to practice. Following initial implementation in 2011, the content of the care pathway was reviewed in 2014 and 2015 to maintain its currency and incorporate new literature, with the most recent literature review up to December 2015. MDT consultation and feedback was sought after each content update.

Clinician compliance

Following initial implementation and the two subsequent content updates, clinician compliance with the care pathway was assessed at three time points: 2011, 2014 and 2015. Data was collected for 20 patients over a two to 4-month period at each of these time points from the electronic medical record, paper medical histories and allied health clinical activity reporting systems to determine compliance with each element of the care pathway. Inpatient admission lists were screened for new transplant patients until a sample of 20 was reached. Equal numbers of high ($n = 10$) and low risk (n = 10) conditioning therapies were attained at each of the time points.

Assessment of resource requirement

The dietetic resource requirement to deliver evidence-based nutritional care as described in the care pathway was estimated based on an allocation of 60 min for an initial dietetic assessment and 30 min for dietetic review. This time was then extrapolated to calculate estimated total dietetic hours required per 100 patients by low or high nutritional risk as defined in Table 1. High and low risks were determined by expert opinion based on the frequency and severity of treatment-related side-effects.

Results

Pathway development

A total of 32 studies were identified from the literature review and of these 27 were deemed relevant and subsequently critically appraised. The final care pathway content was based on five international evidence-based guidelines [10, 20–23]. A table of evidence describing the evidence for each element of the care pathway is presented in Table 2. Where evidence was lacking, professional consensus from the multidisciplinary consultation underpinned recommendations. In the 2014 and 2015 updates no relevant new literature was identified. However, minor changes were made to the pathway based on clinician feedback and consensus. These changes included the introduction of pre-treatment malnutrition screening in 2014, commencing a post-transplant outpatient clinic in 2015, and reducing the timing of initial dietitian contact from within 24 h to within 48 h in 2011. The final care pathway is presented in Fig. 1.

Resource requirements

The estimated dietetic resources required to deliver evidence-based nutritional care for autologous HSCT patients as described in the care pathway is 180 min per low risk patient and 240 min per high risk patient. This equates to 300 h per 100 low risk patient cases and 400 h per 100 high risk patient cases.

Clinician compliance

The audits demonstrated high compliance with delivery of nutritional care according to the care pathway, with compliance rates over 80% for the majority of components (Table 3). The highest compliance across all three audit periods was for completion of nutrition assessment on admission, initiation of parenteral nutrition and post-discharge follow-up. Components of the care

Table 1 Nutrition risk categories for autologous stem cell transplant based on conditioning therapy

Low risk	High risk
Stanford BCNU[a] conditioning	Melphalan 200 mg/m^2 conditioning
ICE[b] conditioning	Conditioning regimens including TBI[d]
Melphalan 140 mg/m^2 conditioning	By/Cy[e] conditioning
Well nourished (PG-SGA[c] category A)	BEAM[f] conditioning
	Busulphan/melphalan conditioning
	Malnourished (PG-SGA[c] category B or C)

Abbreviations: [a] Carmustine, [b] Ifosfamide, caboplatin, etoposide, [c] Patient-Generated Subjective Global Assessment, [d] Total body irradiation, [e] Busulphan, cyclophosphamide, [f] Carmustine, etoposide, cytarabine, melphalan

pathway with the lowest compliance were enteral nutrition commencement, nutrition assessment on discharge, and frequency of review post day + 2 of HSCT. Mean compliance across all care pathway components and all three audit periods was 84%.

Discussion

Patients receiving autologous HSCT are at high risk of malnutrition with approximately a third developing malnutrition post-HSCT [7]. Providing timely and evidence-based nutritional care is vital, with studies showing improved patient outcomes, including reduced weight loss, shorter length of hospital stay, and more appropriate use of nutrition support intervention associated with dietetic or nutrition support team intervention [11, 24, 25]. This study describes the development of an evidence based nutrition care pathway and the resource requirements for implementation in patients undergoing autologous HSCT. The study findings demonstrate high and consistent clinician compliance with evidence-based nutritional management in this population.

Inconsistencies with implementation of best practice guidelines, particularly those addressing nutrition support methods, have prompted recommendations for the development of standardised protocols to support the multidisciplinary nutritional management of HSCT patients [26–28]. Documents guiding elements and standards of care have been found to promote patient compliance, appropriateness of treatment, improved nutritional outcomes and reduce healthcare costs [29]. Despite these benefits, few organisations have established and implemented such protocols [28]. The present study provides a valuable contribution to the literature by describing the development and subsequent resource implications of such a protocol.

Strong evidence was located from multiple international evidence-based guidelines to guide the screening and nutrition

Fig. 1 Care pathway for the nutritional management of haematology patients receiving an autologous stem cell transplant. Abbreviations: MST, malnutrition screening tool; PG-SGA, Patient-Generated Subjective Global Assessment; BMI, body mass index; SCT, stem cell transplant; HEHP, high energy high protein; EN, enteral nutrition; PN, parenteral nutrition; BCNU, Carmustine; ICE, ifosphamide, carboplatin, etoposide; PSCR, peripheral stem cell transplant; TBI, total body irradiation; Bu/Cy, busulphan cyclophosphamide; BEAM, Carmustine etoposide, cytarabine, melphalan; SMHP, soft moist high protein; ANC, absolute neutrophil count; NGT, nasogastric tube; NJT, nasojejunal tube; EER, estimated energy requirements; NIS, nutrition impact symptoms

Table 2 Evidence supporting development of a nutrition care pathway for patients receiving autologous haematopoetic stem cell transplant

Care pathway component	Evidence	Strength of evidence
Screening	Validated malnutrition screening tool in all patients receiving cancer treatment at repeated intervals	NHMRC[a] grade B [23]
	Validated malnutrition screening tool in stem cell transplant recipients	NHMRC[a] grade D [21]
Timing of Initial dietetic contact	Within 48 h of admission	Professional consensus
Nutrition diagnosis and assessment	Nutrition assessment tool validated in cancer populations	NHMRC[a] grade B [23]
	Nutrition assessment tool validated in stem cell transplant recipients	NHMRC[a] grade D [21]
	Nutrition assessment to be completed on discharge	Professional consensus
Nutrition intervention	Nutrition support therapy	
	- Dietary counselling ± oral supplements	NHMRC[a] grade B [21]
	- Enteral nutrition in setting of inadequate oral intake[b]	NHMRC[a] grade C [20, 21]
	- PN in setting of non-functioning gut[c]	NHMRC[a] grade B [21, 22]
	- PN should be discontinued as soon as toxicities have resolved after stem cell engraftment	NHMRC[a] grade B [21, 22]
	- Dietary counselling regarding foods that may pose infection risk and safe food handling	NHMRC[a] grade C [21]
Frequency of dietetic review[d]	Nutritional follow-up should include weekly determination of body weight, clinical surveillance of hydration status and weekly evaluation of oral food intake	Standard, expert agreement [10]
Follow-up	Dietetic follow-up should be continued for some time after the graft to facilitate resumption of oral feeding and withdrawal from artificial nutrition	Recommendation, expert agreement [10]

Abbreviations: [a] National Health and Medical Research Council; [b] Defined as oral intake anticipated to meet ≤ 60% of nutritional requirements for 3 to 4 days in critically ill patients, 5 to 7 days in significantly malnourished patients, 7 to 10 days in previously well-nourished patients; [c] Defined as the presence of severe mucositis of grade 3 or 4, ileus, intractable vomiting, neutropenic enterocolitis; [d] Dietetic review defined as consultation with the patient and/or discussion of the patient case with a member of the multidisciplinary team and/or review of the patient medical record

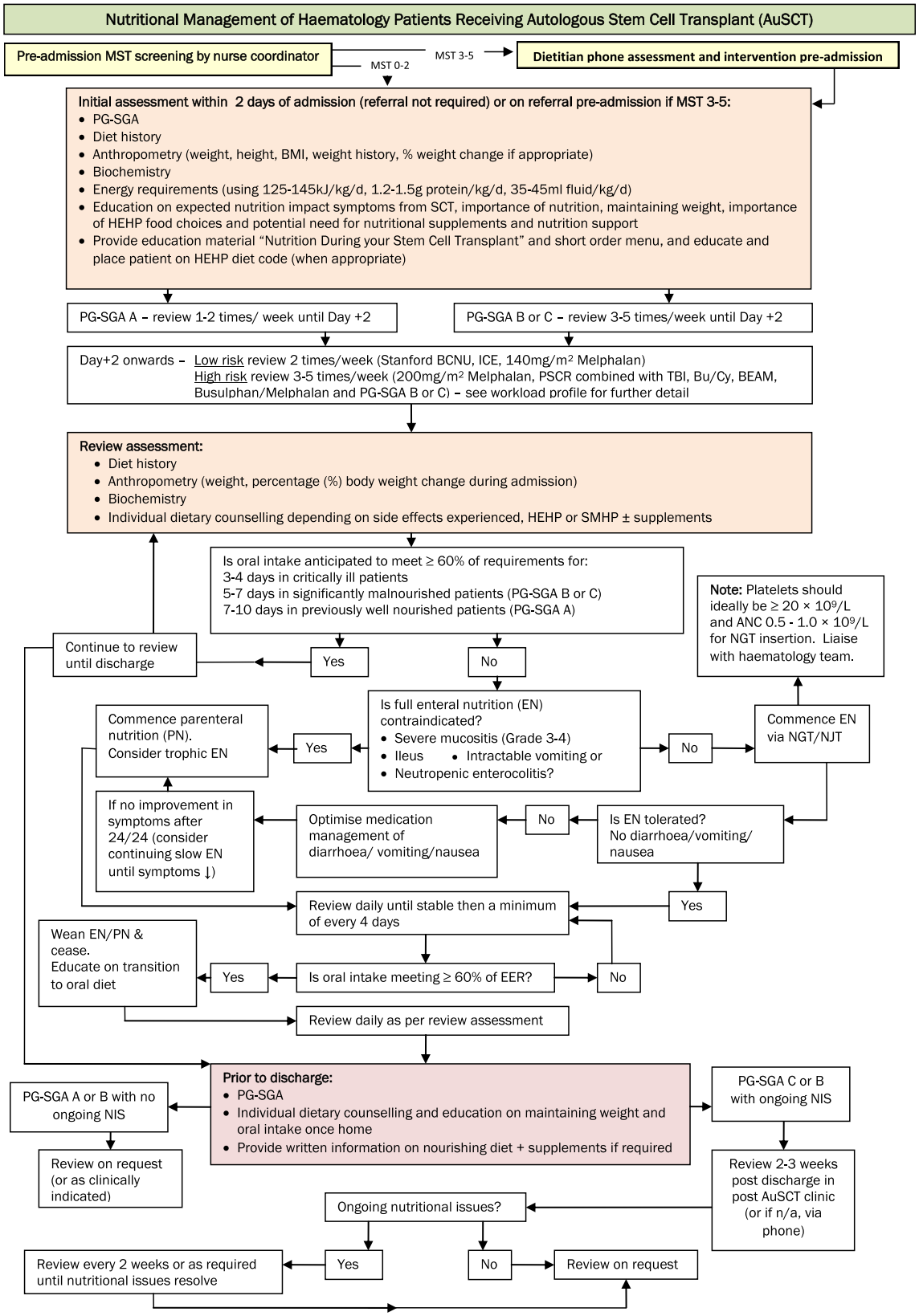
Nutritional Management of Haematology Patients Receiving Autologous Stem Cell Transplant (AuSCT)
Pre-admission MST screening by nurse coordinator
MST 0-2
MST 3-5
Dietitian phone assessment and intervention pre-admission
Initial assessment within 2 days of admission (referral not required) or on referral pre-admission if MST 3-5:
PG-SGA
Diet history
Anthropometry (weight, height, BMI, weight history, % weight change if appropriate)
Biochemistry
Energy requirements (using 125-145kJ/kg/d, 1.2-1.5g protein/kg/d, 35-45ml fluid/kg/d)
Education on expected nutrition impact symptoms from SCT, importance of nutrition, maintaining weight, importance of HEHP food choices and potential need for nutritional supplements and nutrition support
Provide education material "Nutrition During your Stem Cell Transplant" and short order menu, and educate and place patient on HEHP diet code (when appropriate)
PG-SGA A – review 1-2 times/ week until Day +2
PG-SGA B or C – review 3-5 times/week until Day +2
Day+2 onwards – Low risk review 2 times/week (Stanford BCNU, ICE, 140mg/m2 Melphalan)
High risk review 3-5 times/week (200mg/m2 Melphalan, PSCR combined with TBI, Bu/Cy, BEAM, Busulphan/Melphalan and PG-SGA B or C) – see workload profile for further detail
Review assessment:
Diet history
Anthropometry (weight, percentage (%) body weight change during admission)
Biochemistry
Individual dietary counselling depending on side effects experienced, HEHP or SMHP ± supplements
Is oral intake anticipated to meet ≥ 60% of requirements for:
3-4 days in critically ill patients
5-7 days in significantly malnourished patients (PG-SGA B or C)
7-10 days in previously well nourished patients (PG-SGA A)
Note: Platelets should ideally be ≥ 20 × 10⁹/L and ANC 0.5 - 1.0 × 10⁹/L for NGT insertion. Liaise with haematology team.
Continue to review until discharge
Yes
No
Is full enteral nutrition (EN) contraindicated?
Severe mucositis (Grade 3-4)
Ileus
Intractable vomiting or
Neutropenic enterocolitis?
Commence parenteral nutrition (PN). Consider trophic EN
Yes
No
Commence EN via NGT/NJT
If no improvement in symptoms after 24/24 (consider continuing slow EN until symptoms ↓)
Optimise medication management of diarrhoea/ vomiting/nausea
No
Is EN tolerated? No diarrhoea/vomiting/ nausea
Yes
Review daily until stable then a minimum of every 4 days
Wean EN/PN & cease. Educate on transition to oral diet
Yes
Is oral intake meeting ≥ 60% of EER?
No
Review daily as per review assessment
Prior to discharge:
PG-SGA
Individual dietary counselling and education on maintaining weight and oral intake once home
Provide written information on nourishing diet + supplements if required
PG-SGA A or B with no ongoing NIS
PG-SGA C or B with ongoing NIS
Review on request (or as clinically indicated)
Review 2-3 weeks post discharge in post AuSCT clinic (or if n/a, via phone)
Ongoing nutritional issues?
Yes
No
Review every 2 weeks or as required until nutritional issues resolve
Review on request

Table 3 Dietitian compliance with the care pathway

Compliance with care pathway component	Year		
	2011 *N* = 21	2014 *N* = 20	2015 *N* = 20
Screening, *n* (%)	N/A[a]	N/A[a]	15 (75)
Timing of initial dietetic contact, *n* (%)	14 (67)	19 (95)	19 (95)
Nutrition diagnosis and assessment, *n* (%)			
On admission	20 (95)	19 (95)	20 (100)
On discharge	13 (62)	20 (100)	16 (80)
Nutrition intervention, *n* (%)			
Enteral nutrition commenced as per pathway	0 (0)	1 (33)[b]	0 (0)
Parenteral nutrition commenced as per pathway	20 (95)	20 (100)	20 (100)
Discharge education	17 (81)	20 (100)	16 (80)
Frequency of dietetic review, *n* (%)			
Prior to day + 2 of transplant	19 (90)	19 (95)	19 (95)
Post day + 2 of transplant	15 (71)	20 (100)	17 (85)
Follow-up, *n* (%)	20 (95)	19 (95)	20 (100)

Abbreviations: [a] Not applicable since screening was not yet implemented or no patients met the pathway indications to commence enteral nutrition; [b] Percentage represents the proportion of patients who met the indication for enteral nutrition and received it

assessment components of the care pathway [20–22]. Good evidence was located from the same guidelines to support the interventions recommended within the care pathway, including guiding the initiation and cessation of enteral or parenteral nutrition support [20–22]. While the focus of these guidelines was broad and encompassed all non-surgical oncology, they also specifically applied to patients receiving HSCT. The inclusion of food safety nutritional counselling within the pathway was guided by the American Society for Parenteral and Enteral Nutrition guidelines on nutrition therapy during anti-cancer treatment and in haematopoietic cell transplantation [21]. Evidence was weak or lacking around the optimal timing and frequency of dietetic contact and post-treatment follow-up. These components of the care pathway were instead informed by the consensus of multidisciplinary experts indicating further research is required to address these gaps in the literature.

Regular review of the care pathway following initial implementation enables the evolution of the care pathway based on new evidence in the literature. However, the changes to the pathway following initial implementation were largely practical rather than based on new evidence and reflected the lack of new research in the field. The change in the timing of initial dietetic contact, and frequency of dietetic review post day + 2 of HSCT were driven by the initial recommendations for these components being resource intensive, and also took into consideration that these components were based on limited evidence and largely expert agreement. The screening component of the care pathway using the malnutrition screening tool was only introduced in 2014. This was also proposed to assist in reducing any risk associated with delaying the timing of initial contact as patients with pre-existing nutritional risk will have been assessed by the dietitian prior to admission. The care pathway was initially implemented to guide the practice of dietitians. However, during one of the regular reviews consideration was given to recommendations from practice guidelines for routine nutritional assessment in this population and the benefits of proactive screening and preventative nutritional counselling in the stem cell transplant population which prompted the expansion of the pathway to include nutrition screening by nurses [9, 10, 21, 28, 30].

Whilst clinician compliance varied across the components of the care pathway, overall compliance across all three periods was high at 84%. Clinician compliance with completing the initial nutrition assessment, frequency of dietetic review prior to day + 2 of HSCT, discharge education and follow-up was consistently high across all time periods. Compliance with timing of initial dietetic contact and frequency of dietetic review following day + 2 of HSCT were low at the first time period prompting the aforementioned changes to these pathway components. Subsequent audits demonstrated high compliance following these changes. Compliance with the discharge assessment fluctuated across time periods and may be related to the occurrence of unexpected discharges or discharge occurring over the weekend when dietetic services are limited to on-call. Provision of tailored, written education material on assessment was thought to address this area as this resource could be used to guide intake post-discharge. Formal review of nutritional status prior to discharge is an important element of the care pathway in order to direct the need for and urgency of post-discharge dietetic follow-up and prompted the

development of a post-transplant nutrition outpatient clinic. Compliance with commencing enteral nutrition when indicated according to the care pathway was low. This may be in part due to there being only very small numbers of patients who met the indication to start enteral nutrition. However, within these small numbers there was patient resistance to nasogastric tube insertion which has been reported previously in autologous HSCT patients [31, 32].

In our health service, the implementation of the care pathway was delivered without the need for additional allocation of dietetic or other health professional resources. Existing resources dedicated to the haematology service were able to be maintained but utilised in a structured and evidence-based approach to nutritional management supported by the care pathway. The capacity of other health services to implement such a care pathway, however, will be highly variable. Therefore, an estimation of the dietetic resources required to implement the care pathway was determined in order to allow other health services to examine the feasibility or requirements for implementing a similar pathway in their service. It should be considered that for services where dietetic resources are limited, implementation of a nutrition care pathway may require a significant increase in staffing. However, it is important to note that previous research has described reduced costs associated with the delivery of consistent, evidence-based nutritional care in both the stem cell transplant setting and in other oncology patient groups [11, 14, 15, 24]. Anderson et al. implemented and evaluated a nutrition support pathway for HSCT patients, and through the reduced inappropriate use of parenteral nutrition demonstrated substantial cost savings [11]. In head and neck cancer patients, the use of evidence-based nutrition care pathways have also demonstrated significant cost savings through reductions in unplanned hospital admissions and shorter length of hospital stay [14, 15].

Strengths of this study are the detailed description of the process of developing and implementing an evidence-based nutrition care pathway for HSCT patients and the engagement of the multidisciplinary haematology team in this process. Limitations include the assessment of clinician compliance is based on small numbers. Secondly, a comparison of clinical outcomes was not completed prior to and post-implementation of the pathway. However, this was not the intention of the study, rather the intention was to describe the implementation of evidence-based nutritional management. Thirdly, this paper reports on the implementation of this pathway in a single health service and it is recognised that organisational structures and staffing to support the implementation of such a pathway will vary considerably across health services.

This study has described a robust process for developing and implementing an evidence-based nutrition care pathway in patients receiving autologous HSCT and provided information for health professionals or organisations regarding the resource requirement for implementing such a pathway. We were able to demonstrate largely high compliance with the delivery of evidence-based nutrition management using the care pathway indicating the effectiveness of the pathway in supporting the translation of evidence-based recommendations into practice. This study will assist other health services in the implementation of evidence-based nutritional care in the autologous HSCT population.

Acknowledgements The authors would like to thank the multidisciplinary haematology team for their support with the development and implementation of the care pathway. No funding was received to complete this work.

Authors' contributions All authors have made substantial contributions to the design of the study, collection or interpretation of data and writing the manuscript.

Compliance with ethical standards

Conflict of interest None to declare.

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