

# Assessment of hyperbaric patients at risk of malnutrition using the Malnutrition Screening Tool – a pilot study

Hooi Geok See<sup>1</sup>, Yan Ru Tan<sup>1</sup>, Kwan Leong Au-Yeung<sup>2</sup>, Michael H Bennett<sup>3</sup>

<sup>1</sup> Division of Anaesthesiology and Perioperative Medicine, Singapore General Hospital, Singapore

<sup>2</sup> Department of Accident and Emergency, Queen Elizabeth Hospital, Hong Kong

<sup>3</sup> Department of Diving and Hyperbaric Medicine, Prince of Wales Hospital, Sydney, Australia

**Corresponding author:** Hooi Geok See, Block 6 Level 2, Anaesthesiology Office, Singapore General Hospital, Outram Road, Singapore 169608

[see.hooi.geok@singhealth.com.sg](mailto:see.hooi.geok@singhealth.com.sg)

## Key words

Chronic wounds; Hyperbaric oxygen therapy; Nutrition assessment; Outpatients; Prevalence

## Abstract

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**Background:** Nutritional assessment and support is essential for wound management. The hyperbaric oxygen clinic is a unique outpatient service where chronically unwell patients present daily for hyperbaric oxygen treatment (HBOT) over several weeks, allowing time for effective nutritional intervention. This is the first study to examine the prevalence of those at risk of malnutrition in a cohort of hyperbaric medical patients.

**Methods:** A prospective study was undertaken over six months. Following consent, 39 enrolled patients had the Malnutrition Screening Tool and Baseline Characteristic Collection Form completed. Those at risk of malnutrition were given an option to be assessed by a dietitian to complete a Subjective Global Assessment (SGA). At the completion of treatment, the patients completed a questionnaire.

**Results:** Twelve of the 39 patients screened were at risk of malnutrition using our screening process. Of these, all the patients with available SGA results were diagnosed with moderate to severe malnutrition. Patients receiving HBOT for non-healing wounds and osteoradionecrosis were most at risk of malnutrition.

**Conclusion:** The prevalence of patients being at risk of malnutrition in our hyperbaric medical service was about one in three. Malnutrition screening should be part of routine patient assessment in order to ensure patients receive timely nutritional intervention. This may improve wound healing.

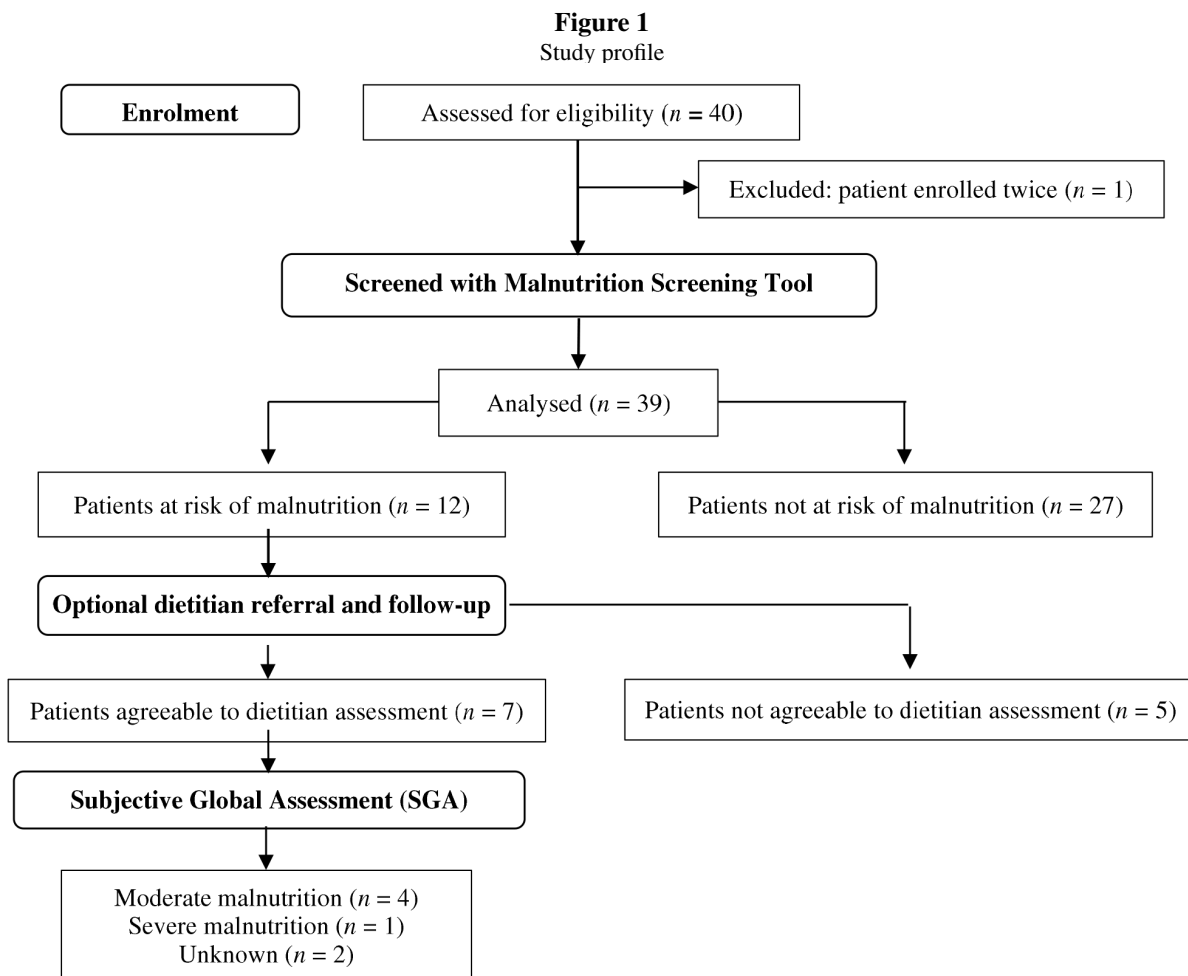
## Introduction

Good nutrition plays a major role in wound prevention and healing.<sup>1,2</sup> International advisory bodies incorporate nutritional assessment and support as standard for wound care prevention and management.<sup>1,3–5</sup> The National Institute for Health and Care Excellence (NICE) recommend malnutrition screening for all hospital inpatients on admission, and all outpatients at their first clinic appointment.<sup>1</sup> In the acute care setting, routine malnutrition screening is supported by level II evidence, with a National Health and Medical Research Council (NHMRC) Grade B recommendation.<sup>6</sup> Most Australian hospitals have implemented malnutrition screening as part of routine nursing workflow for inpatients on admission. This same standard is not applied in the outpatient setting.

There is level I evidence for a high prevalence of malnutrition in the community, which is under-recognised and associated with adverse clinical outcome and cost.<sup>6</sup> Presently, there is only level IV evidence supporting malnutrition screening

in the community.<sup>6</sup> This may reflect the fact that outpatient visits are relatively infrequent encounters. Hyperbaric oxygen treatment (HBOT) requires patients to present daily for treatment over a typical period of four to eight weeks. This period provides hyperbaric physicians with an opportunity to identify malnourished patients and provide appropriate nutritional intervention in tandem with HBOT for wound management.

Many hyperbaric patients have chronic non-healing wounds, such as diabetic foot ulcers (DFU), osteoradionecrosis (ORN) or are at risk of ORN following radiotherapy for head and neck cancers.<sup>7</sup> ORN patients often have significant dental pain, reduced oral intake, weight loss and low body mass index (BMI) – all risk factors for malnutrition.<sup>1,6,8</sup> Malnourished patients have a two to three times increased risk of postoperative complications including infections, prolonged hospital stay, delayed recovery and increased mortality.<sup>1,9–12</sup> Because nutritional support should start seven to 10 days prior to surgery,<sup>9</sup> a preoperative course of HBOT presents an opportunity to establish this.



The primary objective of this study was to determine the prevalence of patients at risk of malnutrition in a cohort of patients treated at the Department of Diving and Hyperbaric Medicine (DDHM) at the Prince of Wales Hospital (POWH), Sydney, Australia. The secondary objective was to identify the category of hyperbaric patients most at risk of malnutrition by comparing the primary indication and baseline characteristics of all recruited patients to those in the at-risk-of-malnutrition group.

## Methods

Following local ethics approval (HREC Ref no: 15/286 LNR/15/POWH/564), we conducted a prospective, single centre cohort study over the six months from 07 December 2015 to 31 May 2016. Patients of all ages who received more than five treatment sessions of either wound care and/or HBOT were included. The requirement for five sessions was an arbitrary threshold to ensure the recruitment of patients committed to attend the DDHM for treatment. This represents the hyperbaric patient population amenable to continuous nutritional intervention. Patients were excluded if the primary indication for HBOT was diving-related decompression illness, an acute medical emergency such

as necrotising fasciitis, gas gangrene or carbon monoxide poisoning or HBOT starting in the immediate post-operative period following limb or flap revascularisation. Typical treatment courses for these patients are much shorter (about one week).

Eligible participants were identified on arrival for assessment by the DDHM staff and written informed consent was obtained before enrolment. The investigator then completed the Malnutrition Screening Tool (MST) ([Appendix A](#)) and the Baseline Characteristic Collection Form ([Appendix B](#)). Patients with an MST score of two or more were deemed at risk of malnutrition and were given the option to undergo formal dietitian review within the following week. Patients were rated A to C using Subjective Global Assessment (SGA).<sup>13</sup> Malnourished patients (SGA-B and C) received continuous nutritional intervention. On completion of treatment, we conducted a follow-up questionnaire ([Appendix C](#)).

In the absence of existing data to perform sample size calculations, we planned to recruit a convenience sample of 30 patients. We planned to perform a descriptive analysis and to use a chi-squared analysis to compare the prevalence

**Table 1**

The primary indication for hyperbaric oxygen treatment and the baseline characteristics of the at-risk-of-malnutrition group compared to all recruited patients

Baseline characteristic	All subjects	At risk of malnutrition
Total number of patients	39	12
Female/male ratio	15:24	7:5
Mean age, years (standard deviation)	66.5 (13.7)	72.5 (9.3)
Indication for HBOT		
Non-healing wound without HBOT	10	1
Non-healing wound with HBOT	7	4
Prevention/treatment of osteoradionecrosis	14	5
Other soft tissue radiation injury	6	1
Sudden sensorineural hearing loss	1	0
Other (e.g., sternum osteoradionecrosis)	1	1
Body mass index (BMI) kg·m <sup>-2</sup>		
Underweight < 18.5 kg·m <sup>-2</sup>	4	4
Normal weight 18.5–24.9 kg·m <sup>-2</sup>	13	5
Overweight 25–29.9 kg·m <sup>-2</sup>	14	2
Obese > 30 kg·m <sup>-2</sup>	8	1
Diabetes	5	1
Chronic renal impairment	2	0
Chronic gastrointestinal disease	1	0
Smoker or quit less than 3 months	3	1
Alcohol > 2 standard drinks/day	9	5
Pain associated with eating	9	5
Dysphagia	9	4
Pre-existing nausea and vomiting	3	1
Malabsorption suspected	3	1
Current dietitian supported	8	2
Prescribed nutritional supplement	6	3

of high malnutrition scores between diagnostic groups. All analyses were made using the StatsDirect analytical package (StatsDirect Ltd, Cambridge).

## Results

The study profile is presented in [Figure 1](#). Thirty-nine patients were enrolled during the study period, of whom 12 were identified to be at risk of malnutrition. Seven of these 12 patients opted for referral to a dietitian. Four patients were diagnosed with moderate malnutrition (SGA-B) and one patient had severe malnutrition (SGA-C). The other

two patients' SGA records could not be obtained. Overall therefore, all five patients with available SGA results were diagnosed with moderate to severe malnutrition. Of the other five who declined referral to a dietitian, one was already seeing a dietitian, one was taking a nutritional supplement and one subsequently saw an external dietitian. Two patients declined without giving any reason.

The primary indication for HBOT and the baseline characteristics of the at-risk-of-malnutrition group compared to all recruited patients are presented in [Table 1](#). Four of seven patients receiving HBOT for a non-healing wound and

five of 14 with/or at risk of ORN were assessed as at risk of malnutrition. Compared to the remainder of the cohort, these two groups of patients were at increased risk, but the difference was not statistically significant (9 of 21 versus 3 of 18; risk difference 26%,  $\text{Chi}^2 = 3.1$ ,  $P = 0.08$ ). No further meaningful statistical analysis was possible due to the small numbers for comparison.

Five of nine patients who reported having more than two standard drinks per day or had pain associated with eating and four of nine patients with dysphagia were identified to be at risk of malnutrition. Patients who were already consulting a dietitian (two of eight individuals) or taking prescribed nutritional supplements (three of six individuals) were still assessed to be at risk of malnutrition. All four patients who were underweight according to body mass index were found to be at risk of malnutrition. In the follow-up questionnaire, 17 of 39 thought the option of seeing a dietitian during their course of HBOT would be beneficial.

## Discussion

HBOT facilities deal with an outpatient population that presents daily to the centre for up to eight weeks. We found over a six-month period that almost one third of the recruited patients were at risk of malnutrition using an accurate and validated tool, the MST.<sup>6,8,12-15</sup> All patients with available SGA results were diagnosed as having moderate to severe malnutrition. This presents an opportunity to provide meaningful nutritional interventions together with HBOT to promote wound healing and reduce post-operative complications.

The overall prevalence of being at risk of malnutrition in our study was higher than the estimated prevalence in the outpatient clinics and community setting.<sup>11,16,17</sup> Data from various outpatient clinics suggest an estimated prevalence of 16 to 21% of patients at risk of malnutrition,<sup>16</sup> while one Australian study involving 1,145 individuals requiring care at home and using the same tools as in our study, showed 15% to be at risk of malnutrition.<sup>17</sup> However, as well as being only a small sample, ours was a highly selected population many of whom had chronic non-healing wounds. The inclusion of only those who had already received five or more treatment sessions into our study might also have skewed our findings.

Mild and/or moderate malnourishment may be hard to identify by untrained healthcare staff. The MST is a widely utilized and validated screening questionnaire for patients at risk for malnutrition<sup>8,13</sup> and has high reliability with 93% sensitivity and 93% specificity in both inpatient and outpatient settings.<sup>6,13-15</sup> It is easily scored by both health care workers and patients with a high inter-rater reliability (93-97%).<sup>15</sup> Any patient who scores two or more on the MST is deemed to be at risk of malnutrition. Using this tool, a patient who lost between 0.5 to 5 kg unintentionally and

ate poorly due to loss of appetite would achieve a score of 2 ([Appendix A](#)).

Trained dietitian are a limited resource, and the diagnosis of malnutrition requires lengthy and detailed nutritional assessment.<sup>6</sup> The MST is used to minimise unnecessary dietitian referrals. Our study suggests the patients undergoing HBOT most at risk are those with non-healing wounds or with/or at risk of ORN, those who are underweight, have more than two standard drinks of alcohol regularly and swallowing with difficulty and/or pain.

Our study has a number of limitations. Five of the 12 patients at risk of malnutrition declined further nutritional assessment and two patients' SGA results could not be obtained, indicating the prevalence of malnutrition might be higher than estimated. Further, we were unable to secure routine dietitian referral in the 'at risk' group and could only offer this support on specific request. The high proportion of those at risk who declined this opportunity was of interest to us and deserves further investigation. Any future investigation will need to be formally planned in conjunction with our dietitian service.

The MST was easily administered and the cost of such screening is negligible. The failure to look for malnutrition when it is so simple to do so is not, in our view, best practice.<sup>18</sup> Any influence on actual clinical outcome remains to be evaluated in future studies.

## Conclusion

This pilot study suggests that among patients presenting to a hyperbaric facility, the prevalence of being at risk of malnutrition is high and justifies the screening of these patients in order to identify those who require intervention. Further investigation is required urgently to better define the potential positive impact of screening and nutritional intervention on outcomes from HBOT.

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**Appendix A**

Malnutrition Screening Tool (MST)

Name:  
 Date of Birth:  
 Study assigned number:  
 Please circle scores and add for a total score

- A. Has the patient lost weight recently without trying?  
 Yes Go to question B  
 No Go to question C  
 Unsure Score 2 and go to question C
- B. How much weight has the patient lost?  
 0.5–5.0 kg Score 1  
 5.0–10.0 kg Score 2  
 10.0–15.0 kg Score 3  
 > 15.0 kg Score 4  
 Unsure Score 2
- C. Has the patient been eating poorly because of a decreased appetite?  
 No Score 0  
 Yes Score 1  
 Nutritional score:

If the patient’s score is 2 or more please refer them to the Dietitian  
 Date referred:  
 Signature:  
 Referrer’s name:

**Appendix C**

Follow-up questionnaire

- Please circle or tick the relevant answer  
 Study assigned number:  
 Date of data collection:
1. Are you aware that nutrition is important for wound prevention and/or healing before the study?  
 Yes / No
2. If you were referred to a dietitian, did you go for consult?  
 Yes / No  
 If Yes, did you find it beneficial?:  
 Yes / No  
 If No, state reason:
3. Is the option of seeing a dietitian during your treatment beneficial?  
 Yes / No  
 If No, state reason:

**Appendix B**

Baseline characteristic collection form; HBOT – hyperbaric oxygen treatment; MST – malnutrition screening tool; NHW – non-healing wound; PORN – prevention of osteoradionecrosis; ORN – treatment of osteoradionecrosis; PEG – percutaneous endoscopic gastrostomy tube; STRI – soft-tissue radiation injury

Please circle or tick the relevant answer  
 Study assigned number:  
 MST score:  
 Date of data collection:

- Primary indication for HBOT  
 NHW without HBOT  
 NHW with HBOT  
 Head and neck STRI (including PORN/ORN)  
 STRI  
 Radiation enteritis  
 Radiation cystitis and proctitis  
 Radiation cystitis only  
 Other STRI  
 Refractory osteomyelitis / intracranial abscesses  
 Sudden sensorineural hearing loss  
 Other:

- Age:  
 Sex: Male / Female  
 Diabetic: Yes / No  
 Chronic renal impairment: Yes / No / on dialysis  
 Chronic gastrointestinal disease: Yes / No (excluding gastric reflux)  
 Smoker or quit less than 3 months: Yes / No  
 Alcohol standard drinks per day: < 2 / > 2  
 Pre-existing PEG tube: Yes / No  
 Pain associated with eating: Yes / No  
 Difficulty in swallowing: Yes / No  
 Pre-existing nausea and vomiting: Yes / No  
 Malabsorption suspected: Yes / No  
 Current dietitian support: Yes / No  
 Prescribed nutritional supplement: Yes / No  
 Body mass index (kg·m<sup>-2</sup>):  
 Underweight (< 18.5)  
 Normal Weight (18.5 – 25)  
 Overweight (25 – 30)  
 Obese (> 30)