Multimodal Nutrition Education for Cancer Patients

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Abstract: Globally, 30%-40% of cancer patients are at nutritional risk, while about 20% of patients die due to malnutrition rather than the tumor itself. Malnutrition in cancer patients can occur at any stage, thus, it is necessary to carry out multimodal nutrition education on several different occasions. We believe that providing education at three important stages: upon admission, during hospitalization and at discharge can provide a good outcome. Multimodal nutrition education can include materials that are experienced through three different senses: seeing, hearing and touching, and can include online education, offline education, oral education and brochures. This literature review indicated that providing nutrition education can not only improve the nutritional status of cancer patients, but can also improve the ability of patients and their families to manage their own nutrition.

Key words: Nutrition; Education; Multimodal; Cancer patients

Introduction

The morbidity and mortality of cancer are serious problems worldwide. According to the World Health Organization (WHO), the number of deaths attributable to cancer was 8.8 million in 2015 (comprising about 1/6 of all deaths), making it the second leading cause of death [1]. It has been estimated that about 10,000 people are diagnosed with cancer every day in China, which means that 7 people are diagnosed every minute [2]. Supporting this high rate, the WHO reported that about 70% of cancers occurred in developing countries (e.g. China) and low-income countries (e.g. India) [1].

Globally, 20%-30% of patients with malignant tumors die of malnutrition rather than the tumor itself, and this proportion is expanding [3,4]. Notably, the WHO indicated that about one-third of cancer-related deaths were attributable to behavioral and dietary risk factors, such as low fruit and vegetable intake, and the lack of nutritional knowledge [1]. Furthermore, about 35% of the morbidity from malignant tumors is related to diet and nutrition. In other words, the implementation of effective nutritional support and education may be able to reduce human death due to malignancy by nearly one third [5]. Therefore, it is crucial to provide adequate nutritional education for cancer patients.

Studies have indicated that nutritional education/popularization can promote cancer patients to make better choices in terms of dietary intake, food types consumed and dietary patterns [6]. In Europe, only 30% to 60% of cancer patients with malnutrition or nutritional risk receive nutritional interventions, and a significant proportion of patients do not receive timely and effective nutritional guidance [5]. In China, it has been suggested that 40% to 80% of cancer patients are clinically malnourished, and these patients are unable to obtain effective nutritional intervention [7].

Obviously, malnutrition in cancer patients is a global issue. According to the guidelines (2011) of the American Society for Parenteral Nutrition and Enteral Nutrition (ASPEN), nutritional screening, nutritional assessment and nutritional intervention (e.g. education, treatment, et al.) are three key steps in nutritional care [8,9]. Similarly, Professor Hanping Shi, the Chairman of the Chinese Society for Oncological Nutrition & Supportive Care (CSONSC), proposed that nutrition therapy should include nutritional assessment, nutrition-based diagnosis and nutritional interventions (e.g. education), nutritional education is the most basic treatment.

To address cancer-related malnutrition, official guidelines for cancer patients were issued by the European Society for Clinical Nutrition and Metabolism (ESPEN). To improve these measures, the ESPEN’s oncologists met at the Cancer and Nutrition Workshop in Berlin in November 2016 to develop guidelines to support multimodal nutrition education [1]. However, China has only recently started to focus on such measures, and providing nutrition education for cancer patients in China is associated with several problems: patients and their families lack nutritional knowledge, there is a lack of nutritional interventions, a lack of understanding of the relationships among nutrition, disease, and rehabilitation, a lack of individualized targeting, non-standard access to nutrition knowledge, and limited coverage, particularly in more remote areas. It is therefore
particularly important for patients and their families to receive comprehensive nutritional interventions that include educational aspects.

Improving patients’ nutrition status is difficult for a variety of reasons, including differences in knowledge among patients, communication and interest among doctors and nurses, poor nutritional documentation, differences in hospital or clinic structure and organization, etc. Logically, no single intervention can address such a complex clinical problem. This gave rise to the idea of a multimodal “bottom-up and top-down” strategic interventional approach, which has been used to improve clinical nutrition in previous reports [9, 10].

As early as 2011, studies pointed out that multidisciplinary and multi-modality nutrition education for cancer patients can not only help to prevent malnutrition, but also reduce the risk of various complications [11]. A multimodal nutrition education intervention (NEI) would combine both the latest technology and conventional methods, and might become a viable means of disseminating NEI [12]. In support of this, previous research indicated that multimodal education (lectures, brochures and text messaging) improved the dietary habits of university students. However, when the conventional methods were used alone, only nutrition knowledge was increased, and the dietary habits remained relatively unchanged [13].

Obviously, multimodal nutrition education is a significant issue that deserves attention. The main goal of this study was to educate cancer patients/their families/caretakers and medical personnel using multimodal nutrition education, to make them aware of tumor-related malnutrition, correct nutritional misconceptions, standardize the implementation of multimodal nutritional education programs and pathway-based interventions, and to ensure that there is a timely and effective response to malnutrition. The goal of our program is to eventually improve awareness, guide behavior, and provide more effective nutrition for cancer patients.

Multimodal Nutrition Education

Studies have shown that using the Nutritional Risk Screening-2002 (NRS 2002) is used upon admission and at discharge for 33.9% and 36.4% of cancer patients [5]. Hongzhen (2017) reported that 86.3% of patients with gastrointestinal tumors were assessed as malnourished at the time of admission. Studies also indicated that 87% of patients with pancreatic cancer showed weight loss when they were admitted to the hospital [14]. During hospitalization and at discharge, another study found that 63% of patients who were hospitalized for 7 days had either the same or worse nutritional status than that at admission (50%-80% of inpatients showed eating difficulties and 30%-70% of the patients presented with poor appetite) [15].

Obviously, malnutrition in cancer patients can occur at any stage. Thus, the time of multimodal nutrition education has to be carried out several time points. We believe it should be given at the time of the first admission, during hospitalization and at the time of discharge. Multimodal nutrition education can also be provided to stimulate three senses: seeing, hearing and touching, in order to more effectively reach patients with different learning styles. Additionally, the education can be provided via different methods, including online/offline education, oral education, brochures, etc. (Figure 1). Finally, different educational contents can be provided via the different formats, with the most important information given in several different ways to make sure the information is taken and retained.

Education at the Time of Hospital Admission

As mentioned above, we believe it is necessary to carry out multimodal nutrition education at the time of admission. The specific steps at the time of admission should include a nutritional assessment, nutritional product guidance and an introduction to the nutrition network platform.

Nutritional risk screening- Touch

A simple physical examination of the patient should be conducted upon admission to carry out the nutritional screening and evaluation of the patient. The main method is to observe and touch the patient to identify ascites and edema, as well as to measure the skinfold thickness, etc. Nutritional risk screening can judge the patient’s nutritional risk by combining multiple indicators, the diseases and symptoms, thus laying the foundation for nutritional assessment [16]. Holm M also illustrated that nutritional screening is the first step of multimodal nutrition education [17]. The process can be explained to patients during the exam, so that they understand how their body exhibits the signs of their nutritional status.

Hou YL used the Mini Nutritional Assessment (MNA) to screen 1,000 patients with tumors for their risk of malnutrition, and the results showed that 367 patients (36.7%) were at risk of malnutrition, with the incidence being highest in patients with liver cancer (56.5%), and the rate being lowest in those with prostate cancer (13.3%) [18].

These data reflect the importance of nutritional risk screening. Various studies have indicated that the results of nutritional risk screening were closely related to the risk of side effects after radiotherapy and chemotherapy, the length of hospitalization, survival and quality of life [19]. The NRS 2002 can also predict the risk of postoperative complications [19, 20].

The NRS 2002 and Patient-Generated Subjective Global Assessment (PG-SGA) are widely used for nutritional screening and assessment when patients are admitted to the hospital, and then multimodal nutritional interventions are performed based on the evaluation results. However, since the sensitivity of the NRS 2002 and PG-SGA to albumin is 43.13% and 82.16%, respectively, the PG-SGA is more frequently used for the nutritional assessment of cancer.
patients at admission [20]. Therefore, after the patient has been screened for nutritional risk using the NRS 2002, a subsequent nutritional assessment should be performed.

**Nutritional product guidance- Hear**

Professor Shi suggested that nutritional education and oral nutritional support (ONS) are the two most important steps of the five-step treatment of malnutrition [9]. People have a fundamental misunderstanding about purchasing health products and formula food for special medical purposes. Therefore, the provision of guidance regarding food for special medical purposes should also be a focus of multimodal nutrition education when patients are admitted to the hospital.

Many patients lack knowledge about these types of foods, and are more likely to buy health products than special medical foods. The market for special medical foods is approximately US$6 to 7 billion per year in the United States. According to statistics from the China Nutritional and Health Food Association, the total amount of special medical food sold in China is about US$ 94 million, accounting for only ~1% of the world’s total [21]. In the United States, 65% of malnourished patients eat special medical foods, compared with 27% in the UK and only 1.6% in the mainland of China [20,21].

The huge difference between China and some developed countries can be partly explained by the shortage of guidance/education. Therefore, it is important for patients to understand different nutritional products. The American Society of Parenteral and Enteral Nutrition (ASPEN) states that nutritional support should be given to patients with nutritional risk or who already have malnutrition, including guidance on the use of the right nutritional products [8].

**Nutrition network platform- See**

In developed countries, using the internet for medical consultations, diagnosis and health education has become a common practice, although the information provided on many sites is dubious at best (e.g. Facebook and Instagram) [22]. The popularity of the Internet and smart phones has also exploded in China, and online social networking technology, such as WeChat, has similarly become very popular. The numerous human/material resources available on the Internet are generally free of charge, and also include not only text, but also images and videos. Therefore, it is very simple, economical and practical for hospitals to use network platforms so that patients can learn nutrition knowledge in different ways (vision/hearing) [23].

When the patient is admitted to the hospital, the nurse should instruct the patient to scan the nutrition network platform QR code (the network platform will share nutrition-related knowledge) so that the patient can learn nutrition-related information from their mobile phone at the three stages (admission, hospitalization and discharge). Studies in China illustrated that the application of the WeChat platform to the health education of ectopic pregnancy patients could increase the patient’s awareness of disease and compliance with treatment [24]. Jin HR et al. also found that the dietary and nutritional guidance provided by WeChat significantly improved the postoperative nutritional status of patients

![Figure 1 The multimodal nutrition education system.](image)
with esophageal cancer [25].

Improving the nutrition-related knowledge of patients and their families can be achieved through the nutrition science/education using the Internet. The hospital’s nutrition network platform can make nutrition science more vivid through the inclusion of a combination of pictures, voice and video. Guidance should be given when the patient is admitted to the hospital so that the education can be continued after discharge.

**Education During Hospitalization**

At admission, the patients receive basic nutrition-related education. During hospitalization, multimodal nutrition education becomes more significant, and combines the visual-auditory-tactile dimensions. Inpatients can thereby obtain comprehensive knowledge about nutrition. The multimodal nutrition education provided during hospitalization encompasses the following four aspects: education curriculum, individualized guidance, nutrition posters/simulated food models, and voice/audio recordings.

**Education curriculum**

The education curriculum is one of the most significant aspects of the multimodal nutrition education. A nutrition education club has been developed in the hospital to provide a bridge between doctors, nurses and patients so that they can experience an enhanced understanding, better communication and so that they can coordinate with each other. Nutrition education clubs, which meet one or two times per month, not only enable patients to learn nutrition-related knowledge in a relaxed environment, but also enable medical personnel to know what kind of nutritional knowledge patients lack [26]. Medical staff can also improve the contents in the next education course.

It is prudent to assist cancer survivors with making informed decisions regarding nutrition and lifestyle changes, including those related to obtaining and maintaining an appropriate body weight, eating a healthful diet and engaging in regular physical activity [27]. An essential measure to achieve these goals is educating the patient about proper nutrition. The contents of the nutrition education courses (e.g. body weight implications, consumption of a plant-based diet and dietary supplement use) need to be easily understood by patients and their families [28]. For example, guiding patients and families to make meal plans is one of the most significant goals of nutrition education. Many patients and their families also lack basic knowledge about food and nutrition, so it may be necessary to provide more remedial information via PowerPoint, such as providing ways that patients and families can better distinguish between red meat and processed meat.

The American Cancer Society (ASC) published *Nutrition and Physical Activity During and After Cancer Treatment: An American Cancer Society Guide for Informed Choices*, which pointed out that the specific contents of the nutrition education for cancer patients should include the following four goals: to achieve and maintain a healthy weight throughout life, to adopt a physically active lifestyle, to consume a healthy diet with an emphasis on plant foods, and to limit consumption if drinking alcoholic beverages [29]. Future studies and meetings should focus on developing standardized multimodal nutrition education, with materials supporting the nutritional self-management of cancer patients.

**Individualized guidance**

During the hospitalization, it is also necessary to provide individualized guidance for patients and their families so that malnutrition can be controlled before discharge. Physicians, nutrition specialist nurses and dieticians should act as the educators for the individualized guidance. Holst M suggested that the individual guidance should be supported by a nutrition team, which includes at minimum a physician, a dietician, a nurse, and a leader (such as a head nurse) [17].

However, in China, the large population and the lack of medical resources make providing individualized guidance difficult. The doctors do not have time to provide individualized guidance for all patients, and only provide general guidance to patients when they make rounds. This further emphasizes the need for multimodal nutrition education, because the patient needs other ways to receive this information.

The roles of nutrition nurses and dietitians are important. Nurses have the most contact time with patients, and nutrition specialist nurses can provide individualized guidance to patients and their families while performing general nursing operations [17]. In addition, the dietitian should provide more specialized nutrition guidance for patients diagnosed with malnutrition and those with PG-SGA scores > 4 points at admission [16,17]. Dietitian should inform the nutrition specialist nurse how to continuously provide nutrition guidance for the patients, so that they can take over their daily nutritional monitoring. Therefore, the provision of individualized guidance via multimodal nutrition education depends not only on physicians, but especially on nurses and nutritionists.

**Nutrition posters and simulated food models**

Delay E suggested that clinical waiting rooms and corridors can also be sites of nutritional education during hospitalization [30]. Posters placed in the clinic waiting rooms and corridors can provide information on energy and protein requirements, food labeling, nutrition and exercise, as well as diabetes, dietary information, etc. Ward K and Hawthorne K found that nutrition posters located in the waiting room were an effective way to promote nutrition education, because 70% patients pass through the waiting room [31]. According to the Delay’s study, it took about 8 hours to make a poster, and a poster was typically kept
Additionally, video information technology can make it easier for patients to understand nutrition-related health content, and it can allow for playback if a topic isn’t understood during the initial viewing. This not only saves the nurse’s time, but also improves the effectiveness of health education by better holding the viewer’s attention [36]. Additionally, the inclusion of TV and radio programs in the wards that broadcast nutritional knowledge on a regular basis would improve education, and patients can also receive nutrition education at anytime and anywhere in the ward.

Although it’s often assumed that the outcome of education through media is limited to the transmission and acquisition of information, there’s evidence that behavioral changes can occur as well [37]. A study conducted at Baylor College of Medicine in Texas showed that education using the radio increased awareness of hypertension, obesity, and diabetes among Hispanics, and one-third of them took action to improve their health.

**Discharge from the Hospital**

In order to test whether the patient has mastered the nutrition-related knowledge after discharge, and to provide the patient with any knowledge they have not yet acquired, multimodal nutrition education should continue after discharge, and mainly includes a discharge brochure and continuing education (follow-up visits and a free hotline).

**Discharge Brochure**

As mentioned above, the multimodal nutrition education intervention described by Shahri MR suggested that brochures were designed for patients to take home and lectures could be recorded to enhance the understanding and memory after the education that was provided during hospitalization [12].

Brochures not only contained some key guidance about cancer-related nutrition, but also indicated some signs of complications. Some studies indicated that the handbooks or brochures should be designed with colored art and a size small enough to conveniently take and read anywhere and anytime [12]. For example, the multimodal nutrition education intervention used brochures that were 35.8 cm × 25 cm. In Sichuan Cancer Hospital, the handbook for patients was designed with different colors and diseases to better hold the patient’s interest.

**Continuing education**

The effective nutritional management of cancer patients is not only dependent on education. After discharge, continuing education (such as follow-up visits and consultations via hotline) from doctors, nurses, and dieticians is also vital to reduce nutrition-related diseases.

When the patient is in the follow-up phase, the role of the multidisciplinary team in the continuing education (follow-up visits) is obvious. Every member of the multidisciplinary team should check the results of the education when they contact the patient, for example, dieticians should check if the patient mastered the food exchanges and carbohydrate counting. Additionally, since
the nurse usually plays a crucial role in nutrition guidance, it is usually that nurse who helps the cancer patients and their families during the follow-up phase. Nurses should check whether the patient understands the nutritional information that the medical staff gave to them during hospitalization, such as the signs of malnutrition [37, 38].

With regard to the hotline, it is easier for patients to contact the nurse and dietician via the hotline, particularly when some emergency situations are encountered. According to the American Institute for Cancer Research (AICR), the availability of a free nutrition hotline enables patients to receive cancer-related dietary guidance after discharge, as well as prevention of cancer recurrence in survivors [38]. The American Cancer Institute also recommended that the nutrition hotline should rely on oncology nutritionists or cancer support service teams, such as nutrition nurses and nutritionists [38]. In China, different hospitals have different measures in place to provide discharge support. For example, at Sichuan Cancer Hospital, patients will be notified of the free nutrition hotline when they leave the hospital, and nurses will also encourage patients to call the hotline to promote nutrition and health.

Summary

Tumor-related malnutrition is a serious social issue. It is important to use multimodal nutrition education to guide cancer patients, their family members/caretakers and medical personnel. Multimodal nutrition education can be provided at the time of hospital admission, during hospitalization and at discharge, and should include information that stimulates several senses, including vision, hearing and touch. Multimodal materials, standardized nutrition education, and continuous intensive education can help cancer patients establish healthy eating habits, strengthen their nutritional attitudes, and adhere to a balanced diet. It can also provide the unity of patients’ knowledge, beliefs and behaviors, effectively improving their quality of life and health status.

Conflicts of Interest

There are no conflicts of interest in this article.

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References