



Managing hidden late complications in irradiated head and neck cancer patients using a practical integrative approach: a narrative review

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Abstract: Radiation techniques have evolved in the last twenty years towards ubiquitous use of intensity modulated radiation therapy (IMRT), which has decreased late complications from radiation to the head and neck area. Despite this, devastating sequelae still impair the long-term functioning of head and neck patients. There are the well-known sequelae of trismus, osteoradionecrosis and xerostomia. However, inadequately addressed sequelae such as dysphagia, odynophagia, hypoguesia, internal lymphedema and cognitive impairment do significant hidden damage to patients' quality of life (QOL). Research has demonstrated that QOL can continue to decline even 10 years post radiation treatment, when many clinicians have long since ended follow-ups. Patients often underreport these symptoms and physicians are not trained to specifically ask about these symptoms long-term. This paper will use an evidence-based approach to look at the hidden sequelae of radiation to the head and neck area, review the current data regarding integrative approaches, and provide a practical integrative system for the practicing clinician. A practical system would include exercise, psychosocial techniques for the mind and emotions, meditation and early referral to a registered dietitian nutritionist (RDN) to educate and support the patients' nutritional needs. Integrative techniques have been shown in the literature to provide an increased QOL and also in some studies, a direct improvement in patients' recurrence rates and mortality. If more providers were to understand and put more emphasis on early integrative interventions, it could improve long-term head and neck cancer QOL and mortality outcomes after radiation.

Keywords: Head and neck radiation; sequelae dysphagia; integrative oncology; quality of life after radiation; nutrition and radiation

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Introduction

Clinicians are trained to maximize survival rates. They pay close attention to acute toxicities and make every attempt to limit devastating treatment sequelae. However, once a patient has finished their course of radiation, the focus turns to detecting recurrent disease and oftentimes ignores the patient's ongoing quality of life (QOL). This

approach is too narrow in scope, as there has been growing evidence that improved long-term QOL of the head and neck patient actually leads to, or at least is correlated with, better survival (1,2). If one were to work with the hypothesis that better QOL is important and actually leads to the gold standard of better survival, then the question becomes, what can we do as clinicians to improve a head

and neck cancer patient's QOL after treatment? Also, does QOL improvement actually improve outcomes? Doing a thorough literature search will find very few resources to improve one's knowledge in this area, as long-term QOL studies are difficult to conduct. Those available only focus on the measurables of QOL and not on the actual practices that can be implemented. We present the following article in accordance with the Narrative Review reporting checklist (available at <http://dx.doi.org/10.21037/anpc-20-18>).

Methods

A literature search was conducted via Pubmed Central (PMC) of the United States Library of Medicine National Institutes of Health website. Given the paucity of evidence, an extensive literature search was conducted from 1970 to the present, looking at studies published in peer-reviewed journals either in print or online. Using search terms "quality of life", "Head and neck cancer", "diet," "survival," "nutrition," "meditation," "Radiation therapy," "IMRT," "elderly," "mortality," alone or in combination, citations were found. If the source journal was not available online through hospital affiliations, a library science researcher (Andrea Harrow, Good Samaritan Hospital) assisted in procuring older scientific papers. The methodology for acceptable level of evidence was to prioritize level 1 (systematic review or Meta-analyses) and level 2 (single institution randomized) studies and focus on those. When level one or two evidence was not available, level of evidence 3–6 publications were considered. Level 7 (opinion or editorial of expert) was not considered for inclusion. From this methodology and extensive search, over 100 papers were found and evaluated for inclusion. Fifty-one papers were eventually cited and included in the final submitted manuscript.

Advances in radiation technique improve long-term measurable toxicities

Head and neck radiation techniques have advanced dramatically over the last twenty years, with techniques such as Intensity Modulated Radiation Therapy (IMRT) becoming the standard of care in the community. The ubiquitous use of IMRT in head and neck cancers has allowed radiation oncologists to decrease the radiation dose to critical structures such as the salivary glands, the mandible and the masticator muscles. This tailoring of

dose has significantly decreased radiation sequelae such as xerostomia, osteoradionecrosis (ORN) and trismus (from 25% to 5% in some studies) (3-5). IMRT has also decreased feeding tube duration in head and neck patients (6).

One factor that can confound the improvement seen with IMRT is the use of concomitant chemotherapy which certainly has increased acute toxicity profiles. Retrospective analyses of RTOG data for chemoradiation for head and neck cancer reveal a severe late toxicity rate of 43% (7).

Hidden sequelae of radiation treatment

Despite advances seen with IMRT, head and neck patients still do experience trismus, xerostomia, and ORN especially when the tumor lies in areas where sparing of critical structures is not possible. Many lesser known chronic side effects such as dysphagia, fibrosis, odynophagia, edema, and hyposalivation are also still very prevalent (8). Although less dramatic, these chronic effects are significant and debilitating, not just to the physical functioning of the patient, but also to their mental and emotional wellness.

Dysarthria (speech impairment), has been reported in up to 70% of head and neck patients even 10 years post chemoradiation (9). A more subtle chronic deficit is hypogeusia, a decrease in taste sensation, which can result from radiation exposure. Riva *et al.* demonstrated in nasopharyngeal patients that hypogeusia was significantly higher than in controls more than 2 years beyond treatment (10). This can impact a patient's desire to eat and leave them malnourished as well as decrease their QOL.

External lymphedema post radiation can impair QOL as well as the ability to rotate the neck fully. A more subtle effect is internal lymphedema, which can last for months after treatment and be debilitating to QOL as well as hearing (11).

Specifically for nasopharyngeal cancer patients treated with chemoradiation using IMRT, increased temporal lobe dose has been correlated with cognitive dysfunction. Kiang *et al.* demonstrated that cognitive symptoms worsened after treatment up to 2.5 years, leveled off, then increased again after greater than 10 years post treatment (12). Due to the low dose "bath effect," IMRT actually may increase the amount of temporal lobe exposed to low levels of radiation. Cognitive deficits after 10 years manifested as problems with verbal self-expression and short-term memory. Although further study is necessary, other contributing factors could be carotid artery damage (13) and untreated hypothyroidism (14).

Dysphagia and odynophagia post radiation

Funk *et al.* found dysphagia present in 50% of individuals at 5 years post treatment and odynophagia in 15% of patients. The biggest predictor of still having dysphagia 5 years after treatment was pain and eating deficits one year post radiation (15).

Dysphagia can lead to weight loss, aspiration. It can also decrease QOL as patients are forced to restrict their diet and social activities involving eating. Many patients are embarrassed to discuss dysphagia, or do not think of it as a medical problem that should be discussed with their physician. To appropriately track the emergence of dysphagia, it is important to ask the patient about any swallowing difficulties prior to radiation planning, as well as throughout the treatment course. Dysphagia may result as a long-term side effect of radiation as well and therefore upon subsequent follow up, this should be discussed as well (See Supplementary 1 for a simple screening tool).

Dysphagia is often noted with particular foods, but can also be due to liquids or pills. Various strategies can be employed regarding foods. Avoiding certain offenders, for example, meats; may be needed. Otherwise cutting foods into small pieces may alleviate the problem. This is referred to as a “mechanical soft” diet and is utilized in facilities and ordered by nutritionists. A pureed diet may be necessary for more advanced dysphagia. With liquids, often it would be indicated to avoid thin liquids. Thickener can be added to water, thin juices, and coffee for example. Regarding pill dysphagia, it may be required to change prescriptions to smaller pills, or for the patient to cut their pills, or crush them and take them with food such as applesauce or pudding.

For anyone experiencing dysphagia, a swallow study would be indicated, with the most common form being a barium swallow study. This would indicate the type and level of dysphagia of the patient and further recommendations can be made accordingly. If a patient is in a long-term care facility, a speech therapist can also perform a “bedside” swallow evaluation in which various consistencies of foods and beverages can be ingested while the therapist closely monitors. In either case, the speech therapist along with an RDN can make recommendations on a safe diet, while ensuring adequate nutrition.

Nutritional considerations during treatment can impact long-term QOL

Prioritizing nutrition during the acute phase of treatment

is the first part of the long-term management of the head and neck patient. For the radiation oncologist, nutritional deficiencies are often the easiest to detect as they show up in the history on the initial consultation as a presenting symptom of weight loss or during weekly treatment checks.

Some clinicians as a rule institute feeding tubes when faced with a weight loss of 5–10% of baseline body weight at consultation. This is because the head and neck patient starting with weight loss prior to treatment most likely will lose significantly more weight. However, often what happens, more often than not, is one of two ineffective things: the patient is threatened with a feeding tube and not given one, or the patient is advised to “eat more” in a cursory way by the clinician and allowed to continue without any intervention. There are two reasons for this approach—a lack of knowledge that weight loss prior to treatment is an important predictor of poor prognosis and also because nutrition is not a focus of current Western medical training (16).

Instead of a cursory approach, weight loss on the initial consultation should be a red flag to the treating physician that an intervention is needed as soon as possible. Continued weight loss impairs the patient’s QOL, increases fatigue levels, decreases pain tolerance and decreases treatment accuracy. In extreme cases, electrolyte deficiencies can cause a patient to require an extended treatment break, impacting survival.

There is an alternative to the feeding tube when encountering this issue. Weight loss should instead trigger the clinician to immediately refer the patient for dietary counseling with a nutritionist. This simple intervention has been proven to improve survival outcomes for head and neck cancer patients over supplementation and patient directed ad lib increases in intake (17). Interestingly, early initiation of feeding tube (gastrostomy) has not been shown to improve weight loss as one might expect (18). Also many clinicians prefer that feeding tubes be avoided due to the many complications that arise from tube feeding placement.

Nutritional considerations after treatment

Often the radiation oncologist is asked by the patient and their family about nutritional advice at some point during or after treatment. Although the patient may think the physician would know “what to eat,” it is not widely known by patients that oncologists have little training in nutrition. The *awareness* to refer patients to nutritional counseling before or during treatment has the additional benefit of

creating a relationship between an expert in nutrition and the patient. It educates the patient for nutritional concerns after treatment and provides a considerable resource to avert potentially poor choices in diets and inappropriate food restrictions. Patients often do their own research and look to add “cancer fighting” foods while restricting others, unintentionally restricting caloric intake and thereby lose weight. More specifically, patients will be unaware of the fact that protein intake actually needs to be increased during and after treatment to reverse cancer cachexia (19). It is important to note that a registered dietitian nutritionist (RD or RDN) is preferred as their training is extensive (generally 5 years post bachelor degree) and includes specific medical nutrition training versus a nutritionist, whose training often times is less rigorous and less regulated.

Screening for post-treatment nutritional status

Post treatment screening can be done to determine the overall nutritional status and nutrition intervention needed after treatment. They can include the following:

- ❖ Current body mass index (BMI).
- ❖ Weight loss (% of original weight) during the preceding six months to one year.
- ❖ Physical performance status (in comparison to patient at baseline).
- ❖ Anti-inflammatory and anti-oxidant supplementation needs after treatment (many are limited during radiation).

Specific cancer survivor nutrition recommendations

In looking at the specific recommendations using formulas, it is evident that the expertise of the RDN is necessary to make the decision as to which formula to use. Some practitioners may not have access to these services and thus this section has been included. Ideal Body Weight (IBW) is most often used for chronic head and neck patients who are below their ideal weight. As a significant number of cancer patients are malnourished, it is a common calculated number when looking at calories. Actual Body Weight (ABW) is used for patients who are in a healthy weight range. When patients are overweight or obese, Adjusted Ideal Body Weight (AIBW) can be a better predictor, where $AIBW = IBW + 0.4 (ABW - IBW)$. AIBW allows adequate nutrition without underfeeding the patient even if they are overweight or obese.

These are some potential caloric and protein guidelines for long-term head and neck patients:

- ❖ BMI less than 20: Use IBW: 30 kcal/kg for calories and 1.3 g protein/kg.
- ❖ BMI 21–28: Use ABW (actual body weight): 25 kcal/kg for calories and 1.2 g protein/kg.
- ❖ BMI >28: Use Adj BW: 30 kcal/kg for calories and 1.5 g protein/kg.

It is important to note that having an underweight BMI prior to treatment has been correlated with significantly worse survival in head and neck cancer patients treated with radiation and chemoradiation. Takenaka *et al.* found that 5-year survival rates for underweight patients treated with chemoradiation was 27.1% compared with 60.0% for normal BMI patients ($P < 0.001$) (20).

Placing the patient on a diet higher in plant foods is the most preferable. This includes a diet high in vegetables, fruits, whole grains, legumes, nuts and seeds. It also advises a diet low in saturated and trans fats, red meats, added sugars and alcohol. If patients are overwhelmed by dietary recommendations or refuse to see a nutritionist, the American Cancer Society recommends an easy-to-remember guideline of 2 ½ cups a day of vegetables and fruits.

It should be noted that studies on vegan and vegetarian diets have demonstrated decreased cancer incidence and cancer mortality (21,22). However, in the internet age, it is common to see patients who are misinformed from their own research, whether from the internet or family and friends. It is often the case that patients can inappropriately restrict their diet of certain foods and inadvertently create a caloric and/or protein and even micronutrient restrictions that lead to long-term deficiencies. For example, removing dairy products is a common restriction that is seen. Patients who restrict dairy and do not increase any other sources of calories or protein can leave themselves vulnerable to undernutrition. Additionally, the current trend of vegan diets (no dairy, no meat, no animal products including honey) can leave the head and neck patient malnourished if not planned properly. It is crucial that if patients wish to create these types of restrictions, they be under the care of a registered dietitian to help the patient continue meeting their caloric and nutritional requirements.

Regarding supplementation, the issues are again best managed by a registered dietitian. Self-prescribed vitamin supplementation is taken by over 50% of cancer patients, which in reality has demonstrated a negative effect on mortality rather than a benefit (23). Supplementation should only be used in cases where objective testing has verified a

deficient state. It is important to point out that supplements available on the market are not regulated by the FDA, and thus are best managed by an RDN.

Oral replacement nutrition (ORN), e.g., cans, bottles, powders etc. taken as caloric replacement for those having dysphagia, can maintain weight during treatment. However, after treatment is completed, patients using ORNs were not able to maintain their weight 3 months after treatment. Conversely, when compared to ORNs, patients given nutritional counselling during treatment were able to maintain their weight well after treatment ended (24). That being said, continued use of ORN may be required as part of a dietary plan as it is crucial that calorie and protein needs continue to be met.

Exercise and post treatment considerations

Exercise has not been studied in the head and neck cancer population exclusively, however there is data from the breast cancer post-treatment experience that may bolster what is a common sense recommendation. Speck *et al.* demonstrated an increase in QOL, decrease in mood disturbances and fatigue, and an increase in muscle mass compared with those who are sedentary (25). Also, those breast cancer patients with increased exercise levels had decreased recurrence rates and mortality (26). Exercise has also been shown to be an aid for the cancer patient who is experiencing difficulty maintaining weight (27). These pieces of evidence may lead us to recommend exercise, but it must of course be individualized, as “exercise” to a 75-year-old malnourished oropharyngeal cancer patient looks very different from a regimen given to a 55-year-old early stage laryngeal cancer patient. In the former, it may simply be a walk outside for as long as tolerated, e.g., 10 minutes, where in the latter it may be an elevated heart rate routine for 60 minutes 3 times a week.

Uncovering late complications in follow-up

As mentioned earlier, the mechanical sequelae of radiation for head and neck malignancies are many, ranging from the more obvious (xerostomia and trismus) to the less obvious (hypogusia). Moore *et al.* demonstrated that head and neck patients often underreport their symptoms, especially chronically, as they are either habituated to the situation or they are in fear: fear of addiction for adding pain medications, fear they will not be able to cope if they admit their true level of dysfunction, or fear of a loss of self image (28).

Additionally, Mehanna *et al.* showed that even 10 years post treatment, head and neck patients still demonstrate a 15% decrease in their QOL when compared to 1–2 years post treatment. This might surprise radiation oncologists, as often these patients are referred back to the ENT for continued follow-up after 5 years, or even sooner in many cases (29).

Strategies to address late complications at the time of follow-up

To help combat the hidden detractors to a patient’s long-term QOL, three simple strategies are recommended:

Direct screening questions

The practicing oncologist must specifically ask the patient who has come in for follow up to see if he or she is suffering from any of these sequelae, even if the patient responds with a “I’m doing well” to a general inquiry. Knowing that a significant proportion of patients will underreport, a simple direct inquiry about neck tightness, taste alteration/hypogusia, dysphagia to specific foods, etc. can open the door to additional services that can be life changing (see Supplementary 1 for Short Screener Questions to Use).

Longer term follow-up

Knowing that the patient’s QOL may continue to decline up to a decade after treatment, longer follow-up of the head and neck patient may be useful to uncover these chronic issues. As stated earlier, cognitive dysfunction can also increase even 10 years post IMRT for nasopharyngeal cancer, in the form of short-term memory loss and verbal self-expression. Carotid stenosis from radiation to the neck may also play a role in a patient’s cognitive dysfunction and present 3 to 7 years after radiation (30). Thus, longer term follow-up may be prudent for all head and neck patients, not just nasopharyngeal patients who receive brain dose. A radiation oncologist may think long-term follow-up by the referring otolaryngologist is sufficient, but their knowledge of the treatment plan and radiation brain dose effects would be more limited and their time would more focus understandably on physical dysfunction.

Social support

An additional factor to be considered is the average age

of the post-treatment population of head and neck cancer patients, which is between 60 and 65 years of age. This population is already vulnerable to social isolation even before receiving a diagnosis of cancer, where 25% of those 65 and over are considered to be socially isolated. Social isolation has been found to significantly increase the risk of premature death from all causes (31). Additionally, for those patients exhibiting secondary lymphedema, Deng *et al.* described worse body image disturbance (11) for those who lived alone or lived in urban areas. Living alone, whether widowed or single, would make social connections more difficult. Urban areas could worsen body image disturbance due to the frequent exposure of the patient to people who may make the patient self-conscious or stand out. Secure personal connections are of value and should be encouraged by the practitioner (32). These can come in the form of longer term follow-up with the treating physician, increased family time for isolated patients and referral to support groups. Many nonprofit organizations, such as Cancer Support Community (US), exist specifically for this purpose. It is not uncommon to see head and neck cancer survivors continue to attend support groups many years after ending treatment, as receivers of support, then turning into givers of support.

Specific psychosocial strategies

Upon questioning, the clinician may uncover cognitive or emotional disturbance that requires more intensive care. Funk *et al.* reported that depression was found in 28% of patients 5 years post treatment. Interestingly, older age actually predicted for higher scores in social, mental and aesthetic outcomes, even while reporting worse physical health.

If a social worker is available in the practice, this would be an appropriate time to introduce the patient, if not as a rule for all head and neck patients during or soon after treatment. If a social worker is not available, as is the case for many outpatient radiation oncology centers, the provider may have to place a direct referral. When a patient on follow-up needs additional assistance in dealing with depression, anxiety or PTSD like symptoms, cognitive behavioral therapy (CBT) is a well-studied and effective treatment and has been shown to be more effective than supportive counseling or bibliotherapy (reading therapeutic books) in terms of people fitting the diagnostic criteria for these three conditions (33).

It has been found that head and neck cancer patients prefer one-on-one counselling over support groups. Of

course, insurance coverage is a significant factor. As most clinicians know, insurances and coverages vary widely from region to region and are dependent on the “level” of health insurance paid for. Higher level insurances will generally cover a set number of sessions for cancer patients. The typical CBT course has an advantage in that it is shorter than a psychodynamic therapy course of treatment. In addition to the physical benefits of an exercise regimen, detailed above, exercise interventions have demonstrated an improvement in psychosocial symptoms (34).

Additional considerations for cognitive dysfunction

For any patients who have received low but widespread “bath” dosage to the temporal lobes (35), oncologists should be aware that cognitive dysfunction could be a possible side effect. Patients and family should be made aware of this prior to treatment, so family members and the patients themselves can monitor for a change in cognitive status. When it is found the head and neck patient is experiencing cognitive symptoms, a referral to their primary care physician, a geriatrician (if the patient is of qualifying age) or a neurologist is appropriate. Interestingly, with memory loss, aromatherapy (use of essential oils) may be considered, especially as that there are no side effects. Although not studied in head and neck cancer specifically, aromatherapy has demonstrated positive effects for dementia patients in terms of memory dysfunction. Jimbo *et al.* demonstrated that patches or diffusion of rosemary and lemon essential oils in the morning and lavender and orange in the evening improved cognitive function (36).

Emotional expression and awareness

As stated earlier, head and neck cancer patients often under report symptoms to their providers. It can often be the case that they “underreport” those symptoms to themselves, i.e., they do not admit or may even suppress their emotional responses. In a well-designed study looking at the impact of expression of emotion and cancer recurrence, Boer *et al.* demonstrated that those head and neck cancer patients with an increased ability to express intensity of “negative” feelings (anger, irritability, tension, anxiety) were more likely to survive and less likely to have a recurrence (1). Factors such as TNM stage, age, and smoking were controlled and multivariate analyses still were positive. This study built on previous research by Temoshok *et al.*

who found that a repressive coping style (37) and a habit of putting others needs before their own (38), dubbed “Type C,” increased a patient’s risk for cancer and increased stress markers (39).

In an era where technological and pharmacologic techniques have overshadowed integrative techniques, even the awareness of a benefit to emotional expression in cancer patients is rare, and more often than not, dismissed. Even so, emotionally-based therapies which challenge the patient’s awareness, such as CBT, should be considered if only for a QOL benefit, which as stated earlier, can influence prognosis. Journaling (40) and programs that are designed to increase hope and gratitude have also been shown to be of benefit in reducing anxiety and depression in those with anxiety (41) and those with cancer specifically (42).

Use of meditation-based interventions

The most common fear listed by cancer survivors is an existential fear, one that no radiation oncologist can answer effectively in all cases: “Will my cancer come back?” (43). This is an understandable question and the radiation oncologist may quote statistics. As most clinicians know, statistics often do not assuage that fear, which really is a fear of the unknown. In addition to this fear, there is often depression, anxiety and a lack of acceptance of the post treatment state. Meditation practices have been shown to be very effective in decreasing levels of anxiety, increasing acceptance and increasing QOL for cancer patients.

The type of meditation most studied is a mindfulness-based approach, called in the literature, Mindfulness Based Stress Reduction (MBSR), which has its roots in Buddhism. It has been most studied in breast cancer patients. MBSR has been shown to effectively decrease depression scores, decrease distress, decrease mental dysfunction, increase coping capacity and decrease traumatic impact. Blood samples of patients practicing MBSR also showed increased NK-cell activity as well as improved IL-6 and IL-8 numbers in addition to the self-reported psychological improvements (44). MBSR often entails a relaxation practice, then a hatha yoga practice, walking meditation, then a seated meditation. Lengacher *et al.* demonstrated that 15–40 minutes (participant dependent) of this practice per day for six weeks significantly improved cortisol and IL-6 scores (45), as well as improved telomere length and telomerase activity, a known marker of stress response (46).

Meditation can be accessed through numerous means. Many support group centers and community centers such

as the YMCA (US) offer free relaxation and meditation courses. If the patient is technologically savvy, online courses are also available, along with mobile apps as Headspace and Calm that offer free initial access.

Limitations

This narrative review, although comprehensive of the current literature, lacks the robust level one and level two data to make definitive conclusions in the integrative care of head and neck cancer patients. More research is needed in the area of emotional to physical connection, and especially in the area where an integration of multiple techniques is used in post treatment care, namely the use of dietary, emotional, mental, and spiritual techniques together as a coordinated system.

Conclusions

Radiation techniques such as IMRT have significantly improved the most dramatic radiation sequelae of trismus, xerostomia, and osteoradionecrosis. The “hidden” sequelae that are still underdiagnosed and undertreated include chronic malnutrition, hypogeusia, lymphedema, dysphagia, cognitive impairment and the resulting anxiety, isolation and depression that result from the lack of solutions to address these issues. One needs to simply be aware of the presence of these possible sequelae, inquire about them, and continue follow-up longer than a typical course, so these issues can be detected and addressed.

Especially with malnutrition, an early referral to a nutritional specialist can be QOL improving, if not lifesaving. A simple screening done in the clinic by the oncology staff can identify an at-risk patient who may benefit from seeing a Registered Dietician Nutritionist. In Supplementary 2, we have included a sample Nutritional Care Process using BMI and weight loss as parameters.

Unfortunately, many of the hidden sequelae of head and neck radiation do not have a physical treatment, as the deficits are sometimes unalterable. This does not mean there are not solutions to address each of these. Evidence-based integrative solutions, such as the ones presented above, have been studied and effectively implemented by practitioners outside of the oncology arena. It would be wise to consider referral to these experts, including therapists, nutritionists, MBSR/meditation teachers, and cancer support centers.

If these evidence-based integrative techniques are

encouraged by the oncologist, it might lead to increased acceptance by the patient who many times is unaware of the possible benefits. If one of the above techniques is accepted by the patient, it can improve QOL on its own. If in the ideal case that all of these techniques (appropriate for the patient of course) were to be recommended and accepted, it would encompass a truly integrated approach. Ideally, the oncologist would have a ready referral system for a nutritionist, a therapist, and even a support center where meditation is taught. This could dramatically improve a patient's QOL, if not their survival. Once these patients report back to the clinician, assuming they have seen a benefit, it might also inspire the clinician themselves to learn some of these techniques to improve his or her own QOL and reduce burnout.

Future research should include more of a focus on nutrition as well as integrative techniques. They also should have a longer follow-up time to further elucidate the effects on mortality that have been demonstrated in this narrative review.

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Supplementary 1 Screening questions: (6 Questions that will catch the majority of issues on follow-up)

1. Are you having pain on swallowing certain foods? (Dysphagia/odynophagia)
2. Are you able to turn your head as well as you used to? (Lymphedema)
3. Are you going out to eat as much as you used to? (Dysphagia)
4. Are you having meals with groups of friends and family? (Dysphagia)
5. Do your favorite foods taste good to you still? (Hypogeusia)
6. Have you or anyone you know noticed any changes to your memory or thinking? (Cognitive impairment- Should also be directed to any family members present)

Supplementary 2 Sample nutritional care process

The 4 quadrants of the nutrition care process are as follows: **nutrition assessment, nutrition diagnosis, nutrition intervention and nutrition monitoring and evaluation (ADIME)**

Done by oncology clinic staff:

Basic Nutritional Assessment: Identify patients current BMI and weight loss. Significant values that could identify patients as meeting criteria for malnutrition are: >5% weight loss in 1 month, >7.5% weight loss in 3 months, >10% weight loss in 6 months, >20% weight loss in 1 year. A significant finding would prompt a referral to a Registered Dietician Nutritionist (RDN).

After referral to an RDN:

Nutritional Assessment: Another assessment in addition to the BMI and weight loss that will help determine a patient's nutrition status is their PO intake over the last month. If it is <75% for 1 month or more plus 1 of the weight loss factors above the patient can fall under the category of Moderate Malnutrition according to ASPEN guidelines¹.

Nutrition Diagnosis: Part of the Diagnostic done by the nutritional specialist is the PES statement. (P) nutrition problem or nutrition diagnosis, (E) the etiology or root cause, (S) and the signs and symptoms of the nutrition problem. Per the assessment above the patient's diagnosis from a nutrition perspective would be Moderate Malnutrition. The PES Statement would be: Inadequate oral intake related to difficulty swallowing in the setting of treatment for head and neck cancer (or we could be more specific as to their diagnosis) evidenced by weight loss of >5% in 1 month.

Nutrition Intervention: In order to help resolve the above diagnosis several interventions can be made such as 1) Educating patients on increased calorie/protein foods via PO intake 2) Providing appropriate NOS (Nutrition Oral Supplements) 3) Setting caloric/protein goal to help with anabolism 4) Supplementing PO diet with Enteral Nutrition as needed.

Nutrition Monitoring & Evaluation: In this section we would want to include how to follow up our above intervention to make sure the patient is headed in the right direction. This could include: Monitor PO intake/tolerance and weight. Or if on TF: Monitor TF tolerance, GI and average intake via TF.

¹ https://www.nutritioncare.org/Guidelines_and_Clinical_Resources/Clinical_Guidelines/