# Lung Cancer Care and Prevention

## Lung Cancer

Lung cancer can originate from a variety of cell types within the lungs and is differentiated into non-small cell lung cancer (NSCLC) and small cell lung cancer (SCLC). NSCLC accounts for 85% to 90% of lung cancers and includes squamous cell lung cancer, adenocarcinoma, and large cell carcinoma. SCLC grows more quickly and has often metastasized by the time of diagnosis.[1]

Lung cancer is the second most common cancer and the leading cause of cancer death in both men and women (25%). It is the most preventable cancer in the world.[2] Smoking is the primary cause of lung cancer while radon gas exposure is the second. Environmental carcinogen exposure to asbestos, arsenic, chromium, nickel, tar, mineral oils, mustard gas, silica, diesel exhaust, ionizing radiation, and bis(chloromethyl) ether also increase risk.[3]

Symptoms of lung cancer include a cough that is persistent or worsens, coughing up blood, shortness of breath or wheezing, chronic pneumonia or bronchitis, weight loss, and fatigue. Diagnosis is confirmed through history, X-ray, computerized tomography (CT), sputum, and biopsy. Lung cancer is primarily treated with surgery, and at times with chemotherapy and radiation depending on the type of tumor and extent of metastases.[1]

## Smoking

Tobacco use accounts for 30% of all cancer deaths, causing 87% of lung cancer deaths in men and 70% of lung cancer deaths in women. Each year, over 7,000 nonsmoking adults die of lung cancer as a result of breathing secondhand smoke.[2] Squamous cell carcinoma and SCLC are most commonly associated with smoking. The risk declines with smoking cessation, reaching the risk level of nonsmokers after 20 to 25 years. The major lung carcinogens found in tobacco smoke are polycyclic aromatic hydrocarbons. Additionally, nicotine induces lung cancer cell line proliferation, promotes angiogenesis, and promotes resistance to apoptosis induced by chemotherapy.[4]

The United States Preventive Services Task Force (USPSTF) recommends annual lung cancer screening with a low-dose CT scan in adults aged 55 to 74 years who have a 30-pack per year smoking history and who currently smoke or have quit within the past 15 years. Screening should be discontinued once a person has not smoked for 15 years or develops a health problem that substantially limits life expectancy or the ability or willingness to have curative lung surgery.

Significant positive effects of smoking cessation on the health of lung cancer patients include decreased lung cancer risk, increased survival time, decreased postoperative complications, increased efficacy of chemotherapy, decreased radiation therapy complications, and improved quality of life. Immediate benefits of smoking cessation include improved oxygenation; lowered blood pressure; improved smell, taste, circulation, and breathing; increased energy; and

improved immunity. Lung cancer patients who quit smoking derive the same benefits plus decreased fatigue and shortness of breath; increased level of activity and performance; and improved appetite, sleep, and mood. This is especially important as lung cancer patients have a greater symptom burden than other cancer patients.[4]

See the "Nicotine Use Disorders" tool for more information on working with patients who smoke.

## NSAIDs and Aspirin

The evidence for aspirin and nonsteroidal anti-inflammatory drug (NSAID) use to prevent lung cancer is mixed. A meta-analysis concluded that there was no relationship between aspirin use and lung cancer risk, since a significant protective effect was only seen in low-quality studies.[5] However, a larger meta-analysis concluded that aspirin use with a dose of seven tablets per week could significantly reduce lung cancer risk, but the beneficial effects were not seen in smokers.[6] At this time, it is not recommended to use aspirin or NSAIDs daily to prevent lung cancer, as the side effects may outweigh the benefits.

## Nonpharmacological Therapies for the Prevention and Treatment of Lung Cancer

### Nutrition

**Fruits and vegetables**

A European prospective trial found that a 100-gm per day increase in the consumption of vegetables and fruits (about 1 to 2 servings) significantly reduced the risk of lung cancer, including in current smokers.[7] The intake of fruits and vegetables, especially those rich in carotenoids, reduces lung cancer risk.[8-10] Carotenoid-rich produce includes sweet potatoes, carrots, butternut squash, cantaloupe, sweet red peppers, apricots, peas, broccoli, spinach, and romaine lettuce.

**Protein**

Adequate protein intake is very important for patients with lung cancer since this type of cancer carries a high risk of cachexia. Their protein requirements can exceed 80 gm per day. The best dietary sources of protein are cold-water fish, legumes, lean meats (chicken and pork), nuts, and seeds.[1]

**Soy**

Soy foods consist of soybeans, tofu, tempeh, miso, and soymilk and are a common part of the Asian diet. A 2013 meta-analysis suggests a borderline reduction in lung cancer risk with daily soy protein intake, with a significant inverse association in nonsmokers.[11] The correlation is more apparent in women, with a significantly better overall survival.[12,13] These studies were conducted in Asian populations.

**Obesity**

Obesity is linked to the increased risk of many chronic diseases and cancers. However, being overweight or obese serves as a protective factor against lung cancer, especially in current and former smokers.[14] However, increased abdominal obesity may contribute to the development of lung cancer.[15] Decreased BMI from young adulthood to time of diagnosis is associated with worse outcomes in NSCLC and SCLC patients.[16] There is also significantly lower lung cancer-

related mortality in overweight and obese patients that transfers across sex, race, and smoking status.[17,18] Higher BMI is associated with a longer survival in lung cancer patients.[19] Weight loss should not be actively encouraged in overweight and obese patients with lung cancer, unless it will provide other health benefits.

## Dietary Supplements

**Note**: Supplements are not regulated with the same degree of oversight as medications, and it is important that clinicians keep this in mind. Products vary greatly in terms of accuracy of labeling, presence of adulterants, and the legitimacy of claims made by the manufacturer.

### Beta-Carotene and Vitamin A

Beta-carotene is a vitamin A precursor. The Alpha-Tocopherol Beta-Carotene Cancer Prevention (ATBC) trial and the Beta-Carotene and Retinol Efficacy Trial (CARET), found that supplemental beta-carotene increases the risk of cancer in current and former smokers.[20,21] However, higher dietary beta-carotene and vitamin A reduce the risk of lung cancer.[22]

The carcinogenic effect of beta-carotene stems from its ability to exacerbate DNA oxidative damage and modify p53-related pathways of cell proliferation and apoptosis, leading to the development of cancer. Long-term use of individual beta-carotene supplements was associated with elevated SCLC risk. The vitamins and lifestyle (VITAL) study concluded that a longer duration of retinol use was associated with a significantly higher risk of NSCLC and total lung cancer.[23] Smokers should be advised to avoid beta-carotene and vitamin A supplementation, but they may continue to increase the consumption of fruits and vegetables high in carotenoids.

### B Vitamins, Homocysteine and Methionine

Higher levels of vitamin B6 and folate are associated with a reduction in lung cancer risk.[24] There is no association between vitamin B12 or methionine and lung cancer risk, but homocysteine may increase risk.[25] The intake of foods rich in B6, including cereal grains, legumes, vegetables, meat, fish, and eggs, is encouraged in current and former smokers.

### Fish Oil

A randomized controlled trial (RCT) found that NSCLC patients taking 2.5 gm of EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid) per day during chemotherapy had a significantly increased response rate (35%) and a 40% greater clinical benefit.[26] Another RCT found that stage III NSCLC patients receiving two cans of a protein supplement containing 2.02 gm EPA and 0.92 gm DHA per day had significantly improved quality of life, physical and cognitive function, global health status, and social function after 5 weeks compared to the control group, which received only the protein supplement.[27] Fish oil has anti-inflammatory and antioxidative benefits and can be used to treat cachexia, a common problem in lung cancer patients.[28]

**Dose**: 1000-2000 mg of EPA + DHA daily. May cause bruising and increase risk of bleeding, consider avoiding if hemoglobin is less than 10 or platelets are less than 100.

### Melatonin

Melatonin is a hormone secreted by the pineal gland that regulates the sleep cycle. Many studies have shown that lung cancer patients have disrupted melatonin secretion. Melatonin

prevents tumor metastasis in NSCLC via inducing apoptosis, inhibiting proliferation, invasion and metastasis, and enhancing of immunomodulation.[29] It also inhibits the progression of tumors due to its oncostatic, pro-oxidant and anti-inflammatory effects. Combining treatment with melatonin and chemotherapy maybe synergistic, contributing to prolonged survival and improved quality of life in patients with NSCLC.[30] A dose of 20 mg per day used by patients with metastatic NSCLC receiving chemotherapy results in a higher overall tumor regression rate and 5-year survival rate.[31] It can also be used in lower doses to help those experiencing insomnia.

**Dose:** The adjuvant dose of melatonin is 20 mg at night. For insomnia, the dose is 1 to 10 mg at night. The effective dose for sleep varies greatly from one person to another. Melatonin may cause excessive sedation, vivid dreams, and headaches.

## Physical Activity

Preoperative exercise significantly improves pulmonary function before surgery, and reduces postoperative complication rate, length of stay, and improves quality of life in patients with lung cancer.[32,33] Four weeks of training is required preoperatively to obtain the aforementioned benefits, while 12 weeks of training is required if exercise is initiated postoperatively.[34] For patients with COPD, preoperative exercise training did not improve postoperative pulmonary complications, but it may result in faster recovery. [35] Encourage a regular exercise program pre- and postoperatively to improve outcomes in patients with lung cancer. In patients who do not exercise regularly, supervision with a trainer or enrollment into a pulmonary rehab program would be beneficial.

## Mind and Emotions

### Breathing Exercises

Breathing exercises in lung cancer patients function to correct breathing errors, reestablish a proper breathing pattern, increase diaphragm activity, improve alveolar ventilation, reduce energy consumption, and relieve shortness of breath. Simple breathing exercises consist of lengthening and slowing down inhalation and exhalation, allowing lung cancer patients to take deeper breaths that increase their oxygen intake, instead of shallow breaths that only utilize the top half of their lungs. Breathing exercises significantly improve postoperative pulmonary function, decrease the incidence of postoperative pulmonary complications, and reduce the length of hospital stay by over four days in patients with lung cancer. Both lung expansion techniques (pursed-lip breathing, sustained maximum expiration, breathing patterns, fractional inspiration and spirometry), as well as aerobic conditioning are effective.[36] There is also a significant improvement in quality of life, the performance of daily self-care and social activities, and symptoms of depression and anxiety.[37]

### Reflexology

Reflexology involves applying pressure to the feet, hands, or ears with specific thumb, finger, and hand techniques without the use of oil or lotion. A Cochrane review of two small studies found that reflexology might have some short-lived benefits on anxiety and depression for lung cancer patients.[38]

## Summary

Lung cancer is largely a preventable disease, and the first step is to assist patients with smoking cessation. Improvements in the diet to include fruits and vegetables can also reduce the risk of developing lung cancer, especially in smokers. Patients with lung cancer should be counseled on specific supplements, regular exercise, and breathing techniques that can improve their survival and quality of life. Lung cancer screening with a low-dose CT scan in adults aged 55 to 80 years who have a 30-pack per year smoking history and who currently smoke or have quit within the past 15 years is recommended by the USPSTF.

## Resource Links

- American Lung Association: https://www.lung.org/support-community
- CancerCare®: http://www.lungcancer.org/
- Lung Cancer Alliance: http://www.lungcanceralliance.org/
- Lung Cancer Foundation of America: http://www.lcfamerica.org/
- Lung Cancer Research Foundation: http://www.freetobreathe.org/
- *Passport to Whole Health*: https://www.va.gov/WHOLEHEALTHLIBRARY/docs/Passport_to_WholeHealth_FY2020_508.pdf
- Nicotine Use Disorders: https://www.fammed.wisc.edu/files/webfm-uploads/documents/outreach/im/tool-nicotine-use-disorder.pdf

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"Lung Cancer Care and Its Prevention" was adapted for the University of Wisconsin Integrative Health Program from the original written by Srivani Sridhar, MD (2014, updated 2020). Modified for UW Integrative Health in 2021.

*This Integrative Health tool was made possible through a collaborative effort between the University of Wisconsin Integrative Health Program, VA Office of Patient Centered Care and Cultural Transformation, and Pacific Institute for Research and Evaluation.*

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