Specific Substances Contained in the Exhaled Breath of Patients with Esophageal Cancer

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Esophageal cancer is the ninth most frequent cancer in the world and the fifth most frequent cancer in developed countries. Also, Esophageal cancer has the highest malignancy among digestive cancers, has a higher frequency of lymph-node metastasis than gastric cancer and colorectal cancer, and the distribution of lymph-node metastasis is widespread from the neck to the abdomen. At the time of diagnosis, two of three patients will have tumors that are considered to be inoperable because of patient comorbidities or tumor extension. After surgical exploration, surgical resection is finally possible in only 15 – 20% of all patients. Surgery is considered to be the best treatment for esophageal cancer in terms of loco regional control and long-term survival. However, survival at 5 years for all patients is less than 10%, whether they have undergone surgery or not.¹ The most common symptom of esophageal cancer is dysphasia. However, dysphasia is commonly a late symptom caused by a large cancer. Diagnosis in patients without symptoms is rare and usually involves on accidental medical checkup.

Subjective symptoms, such as a foreign body sensation of food, do not appear until the esophageal cancer has progressed very much, and early detection of esophageal cancer is still difficult. In addition, early detection of esophageal cancer is more difficult than gastric cancer, even if tests, such as medical examinations, are performed, and it is almost impossible to detect early esophageal cancer by barium tests. In esophageal cancer, no biomarkers have shown suitability for use as screening tests. In recent decades, many smell detection studies have been performed with animal and electronic devices.² Diseases such

as infections and malignancies can be associated with changes in host metabolism, accompanied by the production of different metabolic compounds. The analysis of volatile organic compounds (VOCs) that are linked to cancer is a new method in medical diagnostics.³⁻⁷ McCulloch *et al.* reported that ordinary household dogs can be trained to distinguish breath samples of patients with lung and breast cancer from those of healthy volunteers with high accuracy.⁸ Moreover, several VOCs have been identified as candidate substances for the early detection of cancer using gas chromatography-mass spectrometry (GC/MS) in the exhaled breath of patients with lung and breast cancers.⁹⁻¹³ Smell detection for the diagnosis of cancer has the benefit of being non-invasive, and could therefore have great potential as a screening tool. However, there is no data for evaluating breath VOCs in patients with esophageal cancer. Endoscopy has a high hurdle for the general public, and the purpose of this study is to develop a diagnostic method by breath analysis as one of the simpler examination methods.

Specifically, GC/MS is used to identify volatile organic compounds that are specific to the exhaled breath of patients with esophageal cancer.¹⁴

Exhaled breath analysis can be expected to be a future non-invasive screening method for esophageal cancer. In the future, volatile organic compounds released from various cancer diseases will most likely be discovered.

Keywords Esophageal cancer, analysis of volatile organic compounds

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