Mass screening for lung cancer in Japan

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In Japan, lung cancer screening programs have been conducted for several years, based primarily on the screening system for tuberculosis. Since 1987, lung cancer screening has been supported by the national government under the Health and Medical Service Law for Aged, and about 7,000,000 people were screened by this system in 2000. Mass screening examination is annual miniature (100X100 mm) chest x-ray for all screenees and sputum cytology is added for high risk screenees (Over 50 years and Smoking Index =>600 ).

In order to evaluate the efficacy of lung cancer screening, the Japanese Ministry of Health and Welfare organized 6 case control studies as national projects. The result of the first study which was reported by Sobue in 1992, suggested that lung cancer screening reduced the risk for lung cancer death, but not significant (odds ratio:0.72, p=0.07). The second study which was reported by Okamoto in 1999, the odds ratio was 0.535 (95% CI, 0.337-0.850). Another 4 studies were performed in 4 different regions; Miyagi, Gunma, Niigata and Okayama Prefecture, and odds ratios were 0.54, 0.68, 0.40, 0.59, respectively.

And except Gunma Prefecture, three of 4 studies revealed statistically significant reduction of risk for lung cancer deaths. The efficacy of lung cancer screening using chest x-ray and sputum cytology was proved, but the odds ratio is still lower than the other cancer screenings such as cervix or colon, therefore other more effective screening modalities need to be developed.

Low-dose helical computed tomography (CT) is one candidate for this because of its great ability to detect small peripheral nodules. At present, several institutions and research groups are evaluating the utility of low dose helical CT for lung cancer screening. Initial research evaluated the appropriate conditions for CT screening. Their results established the following scanning parameters: 120kVp, 50mA, 10-mm collimation, one rotation of the X-ray tube per second, and table speed of 20 mm/sec. A 30-cm area is scanned, beginning at a point 2-cm superior to the apex and ending at the diaphragm during a single-breath hold of 15 seconds. The parameters were defined and validated to permit detection of nodules greater than 5 mm in size while reconstructing images every 1 cm.

Application of CT was initiated in 1993 by the Anti-lung cancer association (ALCA) and utilizes CT for initial screening. The prefectures of Chiba (1994) and Nagano (1996) respectively initiated screening using a mobile CT scanner unit. The ALCA is a for-profit organization established in 1975 for lung cancer screening. Members pay dues and are entitled to biannual screening. Initial screening consists of frontal and lateral chest x-rays and sputum cytology. CT screening was added in September 1993. Members consist primarily of men with an average age of 62.9 years. 92% of the members are heavy smokers. Lung cancers were detected in 52 of 13,070 examinations (0.4%). Of the 52 cases, 36 cancers (69%) were detected by low-dose helical CT but not visible on standard chest radiography. 42 of the 52 cancers were in stage IA. Lung cancer detection rates were 2.5 times higher after CT screening was initiated. The five years survival rate of lung cancer patients detected by ALCA, before and after introducing CT was 48% and 82%, respectively.

The Society of Thoracic CT Screening collected the data of CT screening in Japan. Sixteen institutes had performed CT screening over 3 years and they screened 23,512 people between January to December 2000 and 1,029 examinees were recommended further examination and 50 lung cancers were detected and 38 were stage IA.

CT screening permits detection of lung cancer at much earlier stages than conventional screening techniques. But there are many problems to spread worldwide. The first problem is proof of efficacy. In order to evaluate the efficacy of low dose helical CT screening for lung cancer, the Japanese Ministry of Health, Labor and Welfare organized a study group as national project. Seven major institutes which had performed CT screening over 3 years participate in this group.

The second problem is that the procedure requires longer and more time-consuming CT image interpretation. The solution to this problem would be to develop a diagnostic support system using computers. Another issue requiring resolution is the need for detection and diagnostic criteria. The use of CT screening in appropriate diagnostic and therapeutic approaches offers great promise for change in the management of patient with lung cancer. Significant advances are anticipated with future applications of this technique.