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Low-dose computed tomography in lung cancer diagnostics

Introduction of low-dose chest computed tomography for early lung cancer diagnostics in target population will increase early lung cancer detection and the cancer survival rate.

Keywords: *lung cancer, morbidity, risk factors.*

Introduction. American Association of Thoracic Surgeons and American Cancer Association recommend an annual screening using low-dose computed tomography (LDCT) for current and former smokers aged 55-80, with a history of smoking 30 packs a year during the previous 15 years. Patients aged 55-79 with a history of smoking of 20 packs a year are also subject to annual screening in the presence of additional concomitant risk factors. Annual screening is also recommended for patients aged of 55-79 with a long-standing diagnosis of lung cancer (LC) [1].

Method of chest LDCT is recommended as a top-priority method in the diagnosis of LC in several clinical guidelines and underpins the National Lung Screening Trial (NLST) in the United States. Inclusion criteria: age between 55 and 74; a history of smoking ≥30 packs a year; cessation of smoking less than 15 years ago for former smokers [1-5].

The results of a comparison of LDCT and chest X-ray published by NLST in 2016 show an advantage of LDCT against chest X-ray in early detection of adenocarcinomas and squamous cell lung carcinomas. Small-cell LC which is the most aggressive form of LC is rarely detected at early stages by both of the methods mentioned above [6]. NLST-based screening was found to miss a significant share of LC cases – up to 39%. The combination of NLST inclusion criteria and emphysema symptoms revealed by computed tomography (CT) allows increasing the LC detectability up to 95% and reducing the number of missed LC cases [7].

Numerous studies on early detection of LC confirm the cost-effectiveness of LDCT screening method with a repeated annual examination of patients at high-risk aged 50 to 64. The proposed anti-smoking measures in the framework of the screening program increase LC screening cost-effectiveness from 20% to 45% [8].

Thus, LDCT is the most effective method of LC diagnostics among target population.

International early lung cancer action program I-ELCAP

I-ELCAP report on the new study design contains the quantitative results of the annual lung CT-screening. I-ELCAP and NLST results provide a significant substantiation of state-financed projects aimed at LC screening efficiency assessment [9].

I-ELCAP and NLST USA protocols are based on LDCT method. The detectability of Stage I LC was 82% according to I-ELCAP vs. 67% according to NLST ($p<0.0001$); the incidence of surgical resection of tumour was 86% and 76%, respectively ($p<0.0001$); the detection of small tumours that resulted in a significantly higher 5-year survival was 83% and 62%, respectively ($p <0.0001$). Such differences strongly support the significance of LDCT method for LC screening [10].

The transition from NLST screening (1993-2005) to I-ELCAP screening (2006-2011) in the US has minimized the frequency and extent of surgical interventions for non-malignant diseases. High speed of recovery was reached for LC patients who underwent surgical resection by video-assisted thoracoscopy and sub-lobar resection – from 10% to 34% ($P <0,0001$) and from 22% to 34% ($P=0,01$) respectively [9,10].

In 2003-2005, 1000 smokers aged 55+, at high risk of LC, with a history of smoking of 10 years and smoking frequency of 1 pack per day, were examined under I-ELCAP in Canada. LC detectability among at-risk population by basic LDCT was 2.2%; of them, 15 (78%) patients had small-sized early-stage resectable cancerous nodes in lungs [21]. According to another I-ELCAP study, early LC in women (n=25) was growing slower: average doubling time was 313 days vs. 137 days in men (n=11). Most of LC cases (n=62, 73%) detected by screening were surgically resectable [11, 12].

I-ELCAP experts believe that LC detected by annual re-screening could often be found during previous CT-testing. Cancer was evident in previous CT-images in 56 (54%) participants of the screening. In 10 patients (18%), cancer has advanced to Stage I by the time of re-screening due to a high rate of LC growth in 54% ($p = 0.01$) [12, 13].

I-ELCAP experts recommend making a preliminary analysis of the benefits of screening of at-risk patients in relation to their survivability depending on the age, the history of smoking and other additional factors. Such analysis should be made on a personal level for each round of screening [14].

Biopsy of pulmonary nodes in the framework of I-ELCAP screening is recommended depending on the size and percentage of its growth to detect and differentiate the suspicious pulmonary nodes and to reduce the incidence of interventions on benign tumours by 16% [15].

Correct CT-image interpretation can minimize unnecessary tests and interventions. The adherence to I-EALCAP protocol and constant training of medical staff reduce the number of false-positive results [16].

Conclusion. Introduction of I-ELCAP protocol allows reducing the share of false-positive results, avoiding the unnecessary surgical interventions on benign tumours, and also decreasing the share of false-negative findings to reduce the number of missed cases of cancer.

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