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**EVOLIUCINĖ MEDICINA:
ŽMOGAUS RAIDOS PERSPEKTYVOS IR SVEIKATA
BESIKEIČIANČIOJE APLINKOJE**

**EVOLUTIONARY MEDICINE:
PERSPECTIVES ON HUMAN DEVELOPMENT AND HEALTH
CONSEQUENCES IN A CHANGING ENVIRONMENT**

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VIRTUAL CT DOSE REDUCTION IN EARLY-STAGE LUNG TUMOUR DIAGNOSIS: PULMONARY NODULE DETECTION AND CHARACTERISATION

Karina ZASYTYTE¹, Jurgita USINSKIENE²

¹Faculty of Medicine, Vilnius University, Vilnius, Lithuania

²Department of Radiology, Nuclear Medicine and Medical Physics, Institute of Biomedical Sciences, Faculty of Medicine, Vilnius University, Vilnius, Lithuania

Contact e-mail: karina.zasytyte@mf.stud.vu.lt

Background and Aim: Chest computed tomography (CT) is central to pulmonary nodule detection and characterisation. In early-stage lung tumour diagnosis, diagnostic value depends not only on nodule visibility, but also on reliable assessment of size, density, margins, solid component and risk category. This review evaluated how virtual chest CT dose reduction affects image quality, nodule detection, measurement accuracy and radiological characterisation.

Materials and Methods: A narrative literature review was performed using PubMed publications from 2020 to 2026. Search terms included lung cancer, pulmonary cancer, chest CT, low-dose CT, ultra-low-dose CT, virtual dose reduction, image quality, radiologist assessment, dose optimisation and image reconstruction. Full-text systematic reviews, clinical studies, simulation studies and phantom-based experimental studies were included.

Results: Twenty publications were analysed. Low-dose and ultra-low-dose CT protocols often remained diagnostically sufficient for basic nodule detection, particularly for larger solid nodules. However, dose reduction increased image noise and mainly affected more complex tasks, including measurement, density assessment, margin evaluation and category assignment. Small nodules, especially 3–8 mm, and subsolid nodules were most sensitive to dose reduction. Virtual dose reduction studies showed that overall tumour visibility may be preserved after substantial dose reduction, but very low simulated dose levels can impair size categorisation, localisation and interpretation. Model-based iterative and deep learning image reconstruction may improve image quality and measurement reliability, but do not fully eliminate these limitations.

Conclusions: CT dose optimisation should not be guided only by the lowest achievable radiation dose. The acceptable dose depends on the diagnostic task, nodule size and nodule type. Advanced reconstruction technologies can help preserve diagnostic value, but careful protocol selection remains essential for small or subsolid pulmonary nodules.

Keywords: early-stage lung tumour, image reconstruction, low-dose computed tomography, pulmonary nodule, virtual dose reduction