

Tomosynthesis in the Diagnosis of Chest Diseases (Literature Overview)

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Abstract

Tomosynthesis (TS) – a medical imaging technique, which is generated any number of sectional images of the patient in a single pass the X-ray tube. In recent years interest to it is revival, due to some of its advantages, compared with conventional radiography and multislice computed tomography. This review of the literature reveals the history of the TS and its main possibilities of application in the thoracic imaging.

Key words: Tomosynthesis, Digital Radiography, Multislice Computed Tomography, Chest Diseases.

References

1. *Asplund S. A., Johnsson A. A., Vikgren J., Svalkvist A., Flinck A., Boijesen M., Fisichella V. A., Mansson L. G., Bath M.* Effect of radiation dose level on the detectability of pulmonary nodules in the chest tomosynthesis. *Eur. Radiol.* 2014. V. 24. No. 7. P. 1529–1536.
2. *Asplund S., Johnsson A., Vikgren J., Svalkvist A., Boijesen M., Fisichella V., Flinck A., Wiksell A., Ivarsson J., Rystedt H., Mansson L. G., Kheddache S., Bath M.* Learning aspects and potential pitfalls regarding detection of pulmonary nodules in chest tomosynthesis and proposed related quality criteria. *Acta Radiologica.* 2011. V. 52. No. 5. P. 503–512.
3. *Bath M., Svalkvist A., Von Wrangel A., Rismyhr-Olsson H., Cederblad A.* Effective dose to patients from chest examinations with tomosynthesis *Radiat. Prot. Dosim.* 2010. V. 139. No. 1–3. P. 153–158.
4. *Dobbins III J. T., McAdams H. P.* Chest tomosynthesis: technical principles and clinical update. *Eur. J. Radiol.* 2009. V. 72 No. 2. P. 244–251.
5. *Dobbins III J. T., McAdams H. P., Song J. W., Li, C. M., Godfrey D. J., Delong D., Paik D., Martinez-Jimenez S.* Digital tomosynthesis of the chest for lung nodule detection: interim sensitivity results from an ongoing NIH-sponsored trial. *Med. Phys.* 2008. V. 35. No. 6. P. 2554–2557.
6. *Doo K. W., Kang E. Y., Yong H. S., Ham S. Y., Lee K. Y., Choo J. Y.* Comparison of chest radiography, chest digital tomosynthesis and low dose MDCT to detect small ground-glass opacity nodules: an anthropomorphic chest phantom study. *Eur. Radiol.* 2014. V. 24. No. 12. P. 3269–3276.
7. *Jung H. N., Chung M. J., Koo J. H., Kim H. C., Lee K. S.* Digital tomosynthesis of the chest: utility for detection of lung metastasis in patients with colorectal cancer. *Clin. Radiol.* 2012. V. 67. No. 3. P. 232–238.
8. *Kim E. Y., Chung M. J., Choe Y. H., Lee K. S.* Digital tomosynthesis for aortic arch calcification evaluation: performance comparison with chest radiography with CT as the reference standard. *Acta. Radiol.* 2012. V. 52. No. 1. P. 17–22.
9. *Kim E. Y., Chung M. J., Lee H. Y., Koh W. J., Jung H. N., Lee K. S.* Pulmonary mycobacterial disease: diagnostic performance of low-dose digital tomosynthesis as compared with chest radiography. *Radiology.* 2010. V. 257. No. 1. P. 269–277.

10. Lee G., Jeong Y. J., Kim K. I., Song J. W., Kang D. M., Kim Y. D., Lee J. W. Comparison of chest digital tomosynthesis and chest radiography for detection of asbestos-related pleuropulmonary disease. *Clin. Radiol.* 2013. V. 68. No. 4. P. 376–382.
11. Lee K. H., Goo J. M., Lee S. M., Park C. M., Bahn Y. E., Kim H., Song Y. S., Hwang E. J. Digital tomosynthesis for evaluating metastatic lung nodules: nodule visibility, learning curves, and reading times. *Korean. J. Radiol.* 2015. V. 16. No. 2. P. 430–439.
12. Quaiia E., Baratella E., Cioffi V., Bregant P., Cernic S., Cuttin R., Cova M. A. The value of digital tomosynthesis in the diagnosis of suspected pulmonary lesions on chest radiography: analysis of diagnostic accuracy and confidence. *Acad. Radiol.* 2010. V. 17. No. 10. P. 1267–1274.
13. Quaiia E., Grisi G., Baratella E., Cuttin R., Poillucci G., Kus S., Cova M. A. Diagnostic imaging costs before and after digital tomosynthesis implementation in patient management after detection of suspected thoracic lesions on chest radiography. *Insights Imaging.* 2014. V. 5. No. 1. P. 147–155.
14. Quaiia E., Baratella E., Poillucci G., Kus S., Cioffi V., Cova M. A. Digital tomosynthesis as a problem-solving imaging technique to confirm or exclude potential thoracic lesions based on chest x-ray radiography. *Acad. Radiol.* 2013. V. 20. No. 5. P. 546–553.
15. Terzi A., Bertolaccini L., Viti A., Comello L., Ghirardo D., Priotto R., Grosso M. Lung cancer detection with digital chest tomosynthesis: baseline results from the observational study. *SOS J. Thorac. Oncol.* 2013. V. 8. No. 6. P. 685–692.
16. Vikgren J., Zachrisson S., Svalkvist A., Johnsson A. A., Boijesen M., Flinck A., Kheddache S., Bath M. Comparison of chest tomosynthesis and chest radiography for detection of pulmonary nodules: human observer study of clinical cases. *Radiology.* 2008. V. 249. No. 3. P. 1034–1041.
17. Vult von Steyern K., Bjorkman-Burtscher I., Geijer M. Tomosynthesis in pulmonary cystic fibrosis with comparison to radiography and computed tomography: a pictorial review. *Insights Imaging.* 2012. V. 3. No. 1. P. 81–89.
18. Yamada Y., Jinzaki M., Hashimoto M., Shiomi E., Abe T., Kuribayashi S., Ogawa K. Tomosynthesis for the early detection of pulmonary emphysema: diagnostic performance compared with chest radiography, using multidetector computed tomography as reference. *Eur. Radiol.* 2013. V. 23. No. 8. P. 2118–2126.
19. Zhang Y., Li X., Segars W. P., Samei E. Comparison of patient specific dose metrics between chest radiography, tomosynthesis, and CT for adult patients of wide ranging body habitus. *Med. Phys.* 2014. V. 41. No. 2. P. 023901-1–023901-12.
20. Zhao F., Zeng Y., Peng G., Yu R., Peng S., Tan H., Liu X., Wang J. Experimental Study of Detection of Nodules Showing Ground-Glass Opacity and Radiation Dose by Using Anthropomorphic Chest Phantom: Digital Tomosynthesis and Multidetector CT. *J. Comput. Assist. Tomogr.* 2012. V. 36. No. 5. P. 523–527.

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