

Commentary

The concept of dual energy CT was first introduced in clinical practice with the advent of dual source CT scans. Although the concept was exciting and had a number of potential clinical applications, the equipment involved was expensive to acquire and run. The recent advent of dual energy protocols in single source CT scans has revived interest in this area. The issue has been the mis registration between the dual energy acquisitions. Eiber et al have demonstrated that it is possible to reliably acquire dual energy scans in patients. The authors further demonstrate that dual energy protocols have a role in the characterization of urinary tract calculi.

Breast imaging is a highly specialized and a highly emotive area of Radiology. The new modalities in breast imaging include MR, elastography tomosynthesis, scintimammography etc. CT scanning has always been considered a high dose technique and has had a limited role in this area. Kalender et al have demonstrated that the dose can be managed while maintaining resolution. Their paper demonstrates that the technique is able to demonstrate microcalcifications down to 100-150 micron and soft tissue lesion up to 2 mm. This performance is obtained at radiation dose levels that are in line with those for screening mammography.

Lin et al have reviewed the role of imaging in risk stratification for cardiovascular disease. Since the advent of Computed Tomographic coronary arteriography there has been a significant interest in the general public in getting this test given the prevalence of this condition in the population. The review highlights the role of less expensive and non-invasive imaging studies with no radiation exposure. The intima media ratio in the carotid artery in particular is highlighted in this review.

Elastography is an innovative way to look at the deformability of lesions in respect to the normal tissue. It is used to noninvasively quantify liver fibrosis in chronic liver disease. Malignant lesions tend to have higher density and are therefore less deformable compared to the normal background. This technique has been applied to breast lesions in differentiating malignant from benign lesions and there is a growing body of literature to support this application. Merino et al describe its use in thyroid lesions. This data needs further validation.

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Targeted dual-energy single-source CT for characterisation of urinary calculi: experimental and clinical experience

OBJECTIVE: To assess the accuracy of targeted dual-energy single-source multi-detector CT (MDCT) for characterisation of urinary calculi.

METHODS: For proof of principle, 71 ex-vivo calculi underwent single-source 256-slice MDCT. Low-dose CT was performed in 154 patients with suspected urinary calculi. In 104 patients with urinary calculi

targeted dual-energy imaging within one breath-hold was added. 46 patients with sufficient material for infrared-spectroscopy were analysed. Potential anatomical misregistrations between 80- and 140-kVp-images and HU-values were measured. DEIs (dual-energy-indices) were compared with the standard of reference. Effective doses were calculated.

RESULTS: In 26 of 46 patients no misregistration was present. Mean deviations were 2.7mm in the z-axis (16 patients) and 4.3 mm in the axial plane (10 patients). The DEIs were 0.018 ± 0.016 for uric acid (UA), 0.035 ± 0.015 for mixed UA and 0.102 ± 0.015 for calcified

stones in-vitro and 0.017 ± 0.002 for UA, 0.050 ± 0.019 for mixed UA and 0.122 ± 0.024 for calcified calculi in-vivo. Significant differences were noted among calcium, mixed UA and UA stones ($p<0.05$). For the low-dose examination mean effective dose was 3.11 mSv. Targeted dual-energy resulted in an extra dose of 1.84 mSv (additional 59.1%).

CONCLUSION: Targeted dual-energy imaging within one breath-hold is feasible for characterisation of urinary calculi using single-source MDCT allowing minimal anatomical discordance.

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High-resolution spiral CT of the breast at very low dose: concept and feasibility considerations

OBJECTIVE: Mammography, today's standard imaging approach, has deficits with respect to the superimposition of anatomical structures. Dedicated CT of the breast so far indicated that it can provide superior soft-tissue imaging, but that it still has significant limitations with respect to spatial resolution and dose. We have assessed novel dedicated breast CT technology.

METHODS: Based on simulations and measurements we developed novel technology which uses direct-conversion CdTe material and photon-counting electronics with 100 μm detector element size for close to 100% dose efficiency. We assessed the potential for the imaging of microcalcifications of 100 to 200 μm diameter and soft-tissue lesions of 1 to 5 mm diameter

by simulations at dose levels between 1 and 6 mGy.

RESULTS: Microcalcifications of 150 μm and soft-tissue lesions of 2 mm diameter were found to be clearly detectable at an average glandular dose of 3 mGy. Separate displays are required for high-resolution microcalcification and for low-resolution soft-tissue analysis. Total CT data acquisition time will be below 10 s.

CONCLUSION: Dedicated breast CT may eventually provide comprehensive diagnostic assessment of microcalcifications and soft-tissue structures at dose levels equivalent to or below those of two-view screening mammography.

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Imaging Assessment of Cardiovascular Risk in Asymptomatic Adults

OBJECTIVE: This article will address the role of coronary artery calcium (CAC) and carotid intima-media thickness screening in asymptomatic at-risk adults and the broader concept of vulnerable plaque as it applies to this population.

vascular risk in asymptomatic adults has been the subject of considerable interest and some controversy. The incorporation of CAC and carotid intima-media thickness assessment into recent guidelines reflects the growing evidence base for these applications.

CONCLUSION: Imaging for assessment of cardio-

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Utility and Interobserver Agreement of Ultrasound Elastography in the Detection of Malignant Thyroid Nodules in Clinical Care

BACKGROUND AND PURPOSE: Malignancy correlates with hardness of tissues and US elastography can potentially analyze the stiffness of lesions. Our aim was to evaluate the utility of US elastography in the detection of malignant nodules and to investigate interobserver agreement with this technique.

for the diagnosis of benign nodules, but histopathologic evaluations were performed when results suspicious for malignancy or malignant results were obtained on FNAB as well as in indeterminate lesions.

MATERIALS AND METHODS: One-hundred three consecutive patients with 106 thyroid nodules were examined prospectively with conventional B-mode sonography and real-time US elastography. All patients were referred for FNAB. Conventional B-mode sonography and US elastographic examinations were performed, and images were separated and independently interpreted by 2 radiologists blinded to pathologic results. US elastogram evaluation was based on a simplified classification of stiffness based on gray-scale patterns, tumor size compared with B-mode, and margins. Interobserver agreement was studied. FNAB was used as the reference standard

RESULTS: In our study, pattern of stiffness based on gray-scale and classification proposed were statistically significant and predicted malignancy with 100% sensitivity and 40.6% specificity. Tumor size when compared with B-mode images or margins was not statistically significant in our study. No false-negatives were found, and an NPV of 100% was seen. Interobserver agreement for US elastography was excellent in our study, with a k index of 0.82 (95% CI).

CONCLUSIONS: We believe that US elastography is a promising technique that can assist in the evaluation of thyroid nodules and can potentially diminish the number of FNAB procedures needed. We believe that it may be useful to introduce US elastography into routine clinical practice.