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VIRTUAL GRID TECHNOLOGY REVIEW

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Digital Radiography

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DIGITAL RADIOGRAPHY SCIENTIFIC REPORT

A novel Virtual Grid software far scattered radiation suppression: initial experience and data analysis

Ospedale di Sassuolo SpA

Introduction

Virtual Grid (VG) is a software product developed for radiology images. The aim of VG is to improve image quality by reducing the deterioration due to the scattered radiation that arrives at the detector.
VG is highly beneficial especially when an anti-scattering grid cannot be used at all (i.e., bedside exams), but improvements in image quality can be afforded also in traditional radiology.

Aim of the study

The aim of this study is to evaluate the improvements in image quality due to VG in thoracic bedside exams.

Method and materials

This study is being performed at Ospedale di Sassuolo (MO, Italy). All patients receiving AP thoracic projection were collected between April and May 2017 independently on sex, age, and presence of medical device inside the chest (e.g., cardiac pacemaker device). Patients for whom, for any reasons, acceptability image quality criteria were not met were excluded from the study. Patients received only one exposure. Since VG is normally adopted in clinical routine at the hospital, for every patient a copy of the diagnostic image was made and standard post-processing (*) was applied on the copy without the use of VG.
Standard post-processing was previously optimized according to radiologists' preferences so that to obtain the best affordable image quality. For both images no manual

	B - IMAGE QUALITY EVALUATION	Score (median)	Statist. Signific.	P
	Respiratory tract			
B1.1	Tracheal-bronchial profiles visualization	1	yes	< 0.001
	Lungs			
B2.1	Lung parenchyma	0	no	0.575
B2.2	Soft tissue profils	1	yes	< 0.001
B2.3	Hilum of lung	0	yes	< 0.001
B2.4	Mediastinal lines	1	yes	< 0.001
B2.5	Pleura (if visible)	0	yes	< 0.001
B2.6	Costophrenic angles	0	yes	< 0.001
B2.7	Apices	0	yes	< 0.001
B2.8	Mediastinum	1	yes	< 0.001
B2.9	Diaphragm	0	yes	< 0.004
	Heart			
B3.1	Silhouette	0	yes	< 0.001
B3.2	Calcified heart valves	0	yes	< 0.004
B3.3	Calcified or dilated aorta	0	yes	< 0.002
	Skeltal system			
B4.1	Ribs	1	yes	< 0.001
B4.2	Clavicle	1	yes	< 0.001
B4.3	Spinal canal	1	yes	< 0.001
	C - GLOBAL COMPARISON			
C1	Overall image quality	0	yes	< 0.001
C2	Exposure	0	yes	< 0.001
C3	Image noise	-1	yes	< 0.001
C4	Anatomical structures contrast	1	yes	< 0.001
C5	Anatomical structures resolution	0	yes	< 0.001
C6	Confidnce in overall diagnostic value	0	yes	< 0.001

TABLE 1

(*) Standard Processing derivation description (DICOM 0008,2111): G1.1e#1.60+0.10,MBF0.8AM0.6

adjustment was allowed. Tags were randomly assigned to the pair of images ("Copy 1" and "Copy 2"), with no information on which one VG was applied or not. For every patient, three experienced radiologists compared "Copy 1" and "Copy 2" images in a side by side setting. No previous knowledge on which image VG was applied was given to the radiologists.
The evaluation was made based on the list of features reported in Table 1. The list of features was developed starting from the NIOSH standard chest radiograph classification guidelines, properly changed in cooperation with a radiologist to adapt to the study purposes.
For each feature the radiologist could assign a preference between the two images following a 5-point Likert scale. Data were collected and analyzed to describe preferences distributions; mean, median and modal values were computed on the entire set of patients. Statistical significance was computed by mean of non-parametric Sign-test. A p value of 0.05 was chosen as significance threshold.

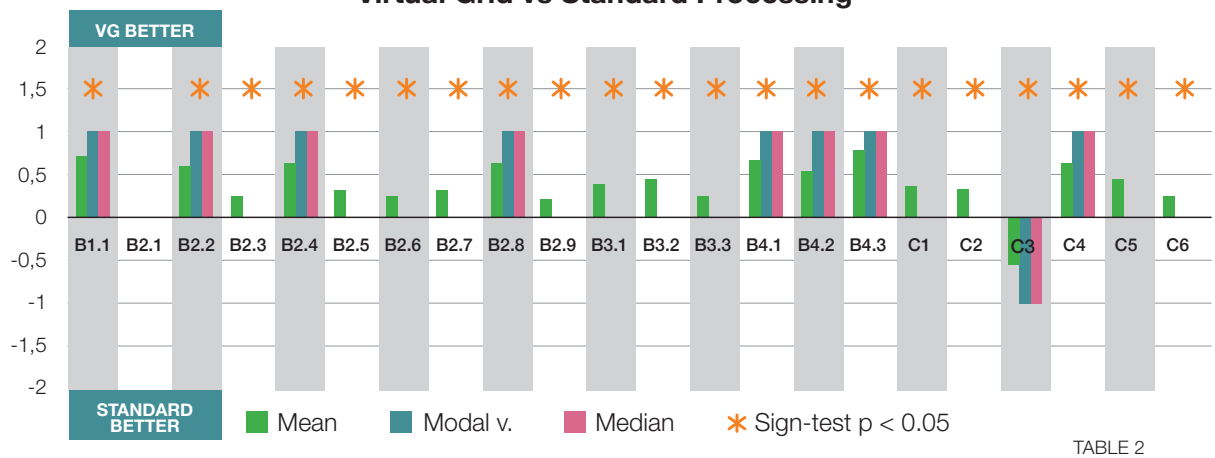

TABLE 2

RESULTS (Preliminary)

45 patients in total were collected in the study. This preliminary analysis reports the evaluations of two experienced radiologists made on the same sample of 30 patients. Mean, median and modal differences in scoring between VG and Standard processing were always in favor of VG and they were statistically significant ($p<0.05$) for almost all the features reported in Table 2. The only exception was feature C3 (Image Noise), for which Standard processing hadstatistically significant better scoring ($p=0.001$).

Preliminary conclusions

VG processing was generally preferred by both radiologists because it was able to increase image quality in a remarkable number of features included in the list. The main exceptions are Lung Parenchyma (B2.1), where preferences are equally distributed between Standard Processing and Virtual Grid Processing, and Image Noise (C3), whose increase is an intrinsic effect of the removal of scattered radiation.

Investigators

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