

Case 8

Quantitative Measurement of Emphysema Using the Automated Lung Parenchyma Analysis Software of syngo InSpace4D

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HISTORY

A 59-year-old asbestos-exposed, male patient who underwent MDCT as part of a lung cancer screening trial was evaluated¹.

DIAGNOSIS

The patient showed severe centrilobular emphysema with architectural destruction. Further analysis was performed using syngo InSpace4D with a new automated lung parenchyma analysis software. After initial 3D segmentation of the lung, the program automatically detects the lung contours and the airways. Then attenuation areas below -950 HU are segmented as emphysema. This threshold has been pathologically validated in several studies^{2,3,4}. Total lung volume (TLV) and emphysema volume (EV) were calculated. Furthermore, areas of emphysema were segmented into four clusters with different volumes (cluster 1: 2–8 µl; cluster 2: 8–65 µl; cluster 3: 65–187 µl; cluster 4: > 187 µl). Software analysis showed a TLV of 8010 ml and an EV of 26.2 percent. Analysis of em-

physema clusters resulted in emphysema volumes of 0.8 percent, 1.1 percent, 0.4 percent, 23.2 percent for clusters 1–4, respectively.

COMMENTS

The automated lung parenchyma analysis software which is integrated in syngo InSpace4D allows quick and reliable three-dimensional evaluation of emphysema, including TLV and EV. Furthermore pattern diagnosis and distribution of emphysema can be calculated. Regional differences can be observed and the exact localisation of the emphysema can be described which yields potential benefit before volume reduction surgery of the lung and therapy response control. In a further step, an analysis of different emphysema cluster, which result in a so called bulla index (BI) was performed. This type of analysis is a new feature compared to previous quantification software (e.g. syngo Pulmo CT)^{5,6}. This advanced evaluation of the emphy-

sema could be important especially for the monitoring of clinical trials of therapy if a shift between the different clusters is detected. A shift, for example, from large clusters to small clusters is a sign of a possible therapy success.

The new automated lung parenchyma analysis software provided a detailed 3D analysis of the pattern of pulmonary emphysema.

EXAMINATION PROTOCOL

Scanner	SOMATOM Sensation
Scan area	chest
Slice collimation	0.75 mm
Scan length	372 mm
Slice width	1 mm
Scan time	16 s
Pitch	1
Scan direction	cranio-caudal
Reconstruction increment	0.7 mm
Kernel	B40
Tube voltage	120 kV
Tube current	63 eff. mAs
Rotation time	0.5 s
Contrast	none
Postprocessing	syngo InSpace4D Automated Lung Parenchyma Analysis Software

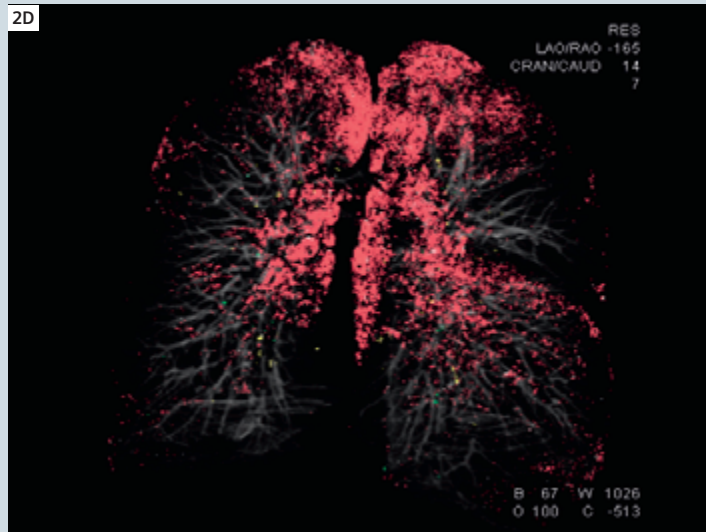
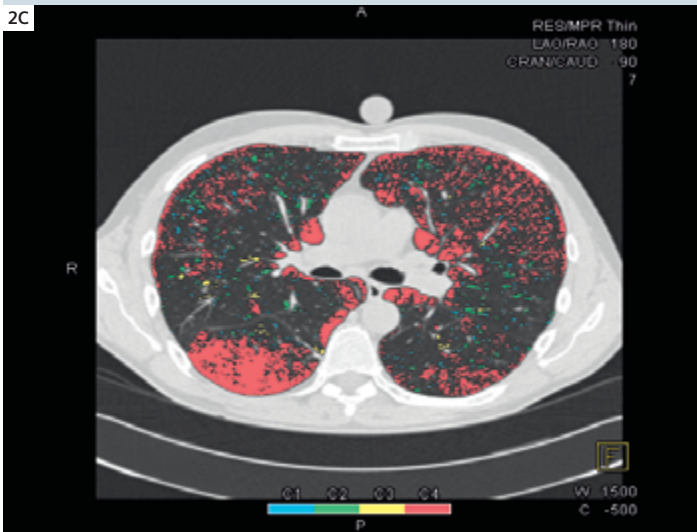
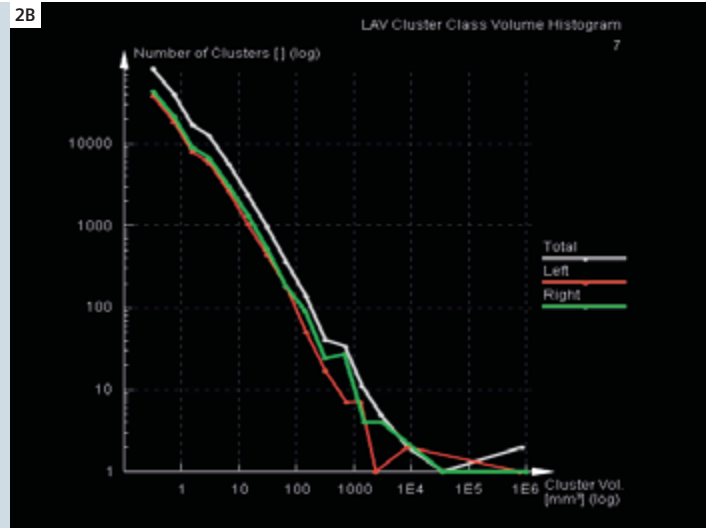
	Total	Left	Right
Vol. [ml]	8010	3697	4313
Rel. Vol. [%]	100.0	46.2	53.8
MLD [HU]	-900	-897	-902
SD [HU]	108	109	107
FWHM [HU]	74	72	76
LAV [%]	26.5	24.9	27.9
HAV [%]	0.3	0.3	0.3

1 The software allows a quantitative three-dimensional analysis of the pulmonary emphysema and gives information about total lung volume and emphysema volume. The low attenuation volume (LAV in %) represents the emphysema index.

2A

Relative LAV Cluster Class Volumes

Cluster	Total	Left	Right
Class 1 [%]	0.8	0.8	0.8
Class 2 [%]	1.1	1.0	1.1
Class 3 [%]	0.4	0.3	0.4
Class 4 [%]	23.2	21.6	24.6
3D BI []	5.0	5.0	5.1



- 2** The color coded clustering shows the distribution of the emphysema in the lung. The absolute volume of size 4 clusters (red colored) is 23.2 percent of the whole lung volume, which indicates a severe emphysema.

References

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