Materials and Methods

**Xenon-Ventilation Dual-Energy CT**

Patients inhaled 30% stable xenon gas using a face mask designed for positive pressure ventilation treatments (King Systems Corporation, Noblesville, IN, USA) and a xenon gas inhalation system (Zetron V, Anzai Medical, Tokyo, Japan). We monitored xenon concentration in the inhaled and exhaled gases throughout the study. After the xenon concentration in the exhaled gas reached 25%, a full-thoracic CT was performed using the SOMATOM Flash CT (Siemens Healthineers, Forchheim, Germany) (55/130 eff. mA at sn140/80 kV, 64 x 0.6-mm collimation, 0.55 pitch, and 0.2-second rotation time). Oxygen saturation was continuously monitored, and the patients notified us of any discomfort or symptoms they experienced during the study. The patients inhaled room air to eliminate the xenon gas from the lung after the xenon-ventilation CT; we monitored the xenon concentrations in the exhaled gas until the xenon concentration was almost 0%. The patients inhaled the room air for another 10 minutes and underwent contrast-enhanced perfusion CT using the SOMATOM Flash CT system (89/210 eff. mA at sn140/80 kV, 64 x 0.6-mm collimation, 0.55 pitch, and 0.28-second rotation time). Full-thoracic CT was performed in full inspiration and single breath-hold in the craniocaudal direction. Each patient was administered 100 mL of an intravenous contrast agent (Ultravist 370, Bayer Schering Pharma, Berlin, Germany or Iomeron 400, Bracco, Milan, Italy), followed by 50 mL of 30% contrast agent using an automated power injector at a rate of 3.5 mL/s. A fixed scan delay of 30 seconds was used. We analyzed only xenon-ventilation data of patients with asthma-chronic obstructive pulmonary disease overlap syndrome and chronic obstructive pulmonary disease (COPD) in this study, and perfusion CT data of patients with COPD were analyzed in a previous study (15).

Results

**Monitoring and Radiation Dose**

The xenon-ventilation dual-energy CT (DECT) examinations were completed successfully in all patients without significant adverse effects of xenon inhalation. The mean dose-length product for xenon-ventilation DECT was 161.7 ± 20.3 mGy·cm. The mean estimated effective dose was 2.3 ± 0.3 mSv, as determined using a conversion factor of 0.014 mSv/mGy per cm.