

# Prevalence of main bronchial diverticula in a general European population

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## SUMMARY

With the technical development of multislice computed tomography (CT), main bronchial diverticula are now a common finding on imaging. Data from three larger studies from Japan and a highly selected patient sample from Europe (lung cancer screening) showed prevalences exceeding 40%. The generalizability to a more general European patient population is unclear. For this purpose a set of 80 thoracic chest CT scans was retrospectively studied. Prevalence of main bronchial diverticula in our sample was 21.25% and a significant correlation with emphysema was found ( $p < 0.01$ ).

**Key words:** Main bronchial diverticula – Computed tomography – Chronic obstructive pulmonary disease

With the technical development of multislice computed tomography (CT) main bronchial diverticula are now a common finding on imaging (Fig. 1). Because of their localization and spot-like appearance on axial CT slices, these bronchial diverticula have also been called subcarinal air cysts (Oshiro and Murayama, 2010). With the use of multiplanar reformations the connection to the bronchial system can be verified in most cases (Higuchi et al., 2010; Oshiro et al., 2010). The data from three larger studies from Japan showed prevalences between 21.6 and 44% (Higuchi et al., 2010; Miyare et al., 2011; Higuchi

et al., 2012). To date there is only data from one European study with a highly selected patient population undergoing CT screening for lung cancer. In this study the exact frequency of main bronchial diverticula was not reported, the cumulative frequency of main and lobar bronchial diverticula was 44.5% (Sverzelatti et al., 2010). There have been no reports of the prevalence of main bronchial diverticula in a general sample of European patients undergoing CT imaging of the chest.

A retrospective analysis of 80 selected thoracic CT scans (October/ November 2012) was performed. Patients were imaged for a wide range of indications including evaluation of lung disease (for example emphysema and fibrosis), suspected pulmonary embolism, and staging of malignant tumours. All Patients with altered mediastinal anatomy due to malignant disease or postoperative changes as well as scans with marked motion artifacts were excluded. The sample consisted of 44 men and 36 women with a mean age of 67 years. All patients were examined on the same 16-slice CT scanner (Activion®, Toshiba Medical Systems, Tokio, Japan) with identical scan parameters (120 kV, 80 mAs, 1mm slice thickness, automatic exposure control). The primary data sets were post-processed on a standard medical workstation. The presence of small rounded air collections adjacent to the main bronchi was searched in the primary axial slices; in cases of doubt multiplanar reformations were performed. All scans were also examined for morphologic signs of emphysema (signs of centri- or panlobular emphysematic changes or an overall decrease in lung density  $< -950$  Hounsfield units (HU)).

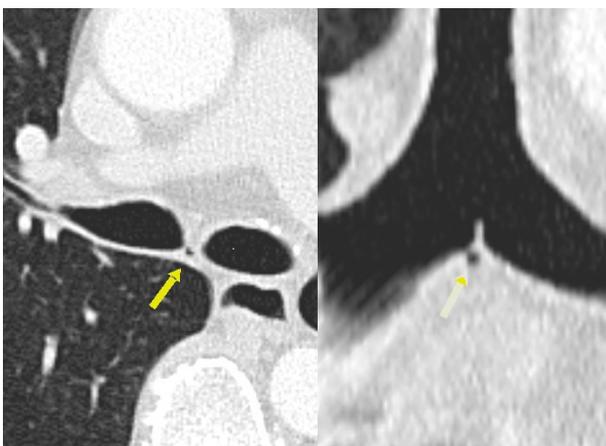
In our patient sample, main bronchial diverticula

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were found in 21.25 % of patients (17/80), most of them in the subcarinal region. In 6.25 % of patients more than one bronchial diverticula were found. Emphysema was significantly more common in patients with main bronchial diverticula (76.4% vs. 33.3% of patients,  $p < 0.01$  (chi-square test)). Mean age and gender were not significantly different.

Bronchial diverticula are a well-known entity. In an elderly study with postmortem bronchography, around 30% of patients with chronic bronchitis showed bronchial diverticula (Müller, 1973). With the technical evolution of CT, the presence of bronchial diverticula has been increasingly noted on CT imaging of the chest by radiologists, mainly in the subcarinal region. In accordance with Miyara et al. (2011), we found main bronchial diverticula in around 21% of chest CT of a general hospital patient sample. Higuchi et al. (2010, 2012), reported a higher prevalence of 41 and 44% in two studies, but these differences may be in part explained by the use of thinner collimation (0.6 mm slice thickness compared to 1 mm in our patients) with increased spatial resolution. Sverzellati et al. (2010) also found a high prevalence of bronchial diverticula in 45.5% of heavy smokers undergoing lung cancer screening with CT, but in this study the exact prevalence of main bronchial diverticula was not specified. There is considerable debate about the correlation of bronchial diverticula to smoking and chronic obstructive pulmonary disease (COPD). Miyara et al. (2010) found a correlation of bronchial diverticula and smoking. This is in accordance to the found high prevalence in heavy smokers undergoing screening for lung cancer with CT in the study by Sverzatti et al. (2010). In this study there was also a correlation to airflow



**Fig. 1.** Computed tomography of a 57 year-old male patient showing main bronchial diverticula in the subcarinal region (“subcarinal air cyst”). On the coronal reformation, the connection to the right main bronchus can be easily seen.

impairment. In our sample of a general hospital population, emphysema was significantly associated with main bronchial diverticula ( $p < 0.01$ ). As emphysema is a common consequence of chronic obstructive pulmonary disease due to smoking, our data adds further evidence to the possible connection of bronchial diverticula with smoking and COPD. In this scenario the formation of bronchial diverticula is explained by chronic elevated pressure in the large airways with COPD. In the study of Müller (1973), the diverticula microscopically corresponded to ectatic intramural ducts of bronchial wall glands with chronic inflammation. These intramural ducts may be dilated either by excess sputum production or chronic elevated airway pressure, as has been supposed in recent studies. In contrast with the above cited studies, Higuchi et al. (2010) denied a correlation of bronchial diverticula to lung disease. They examined only asymptomatic volunteers and all patients with visible significant lung abnormality were excluded. In this scenario the diverticula may be explained as congenital variant anatomy.

Bronchogenic cysts are another congenital lesion occurring in the subcarinal region. They are a result of an abnormal budding of the foregut. On CT imaging usually there is a rounded mass with water or soft tissue attenuation. Rarely an air-fluid level can be found (McAdams et al., 2000). In contrast to bronchial diverticula there is no obvious connection with the bronchial lumen, so these two entities can be distinguished on imaging.

From a clinical point of view it is important to be aware of incidentally found parabronchial air collections on imaging. Especially in cases after trauma reporting physicians should not confuse them with pneumomediastinum.

In conclusion, main bronchial diverticula are a frequent finding in patients undergoing CT of the chest. As there are numerous unresolved questions (exact etiology, correlation to lung disease) a large prospective study is warranted to clarify the connection of main bronchial diverticula and lung disease, favourably including not only imaging studies but also morphological and histological examinations.

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