Bronchocele: Demonstration By 3D Volume Rendering Imaging with Multidetector Computed Tomography: Case Report

Bronkosel: Çok Kesitli Bilgisayarlı Tomografi ile Yapılan 3 Boyutlu Görüntülerle Gösterilmesi

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ABSTRACT Congenital bronchial atresia (CBA) is a rare congenital abnormality of the lung. It results from a congenital focal obliteration of a proximal segmental or sub-segmental bronchus with normal development of distal structures. Because of proksimal bronchial stenosis, the distal bronchi became filled with mucus and form a bronchocele. Three dimensional (3D) volume rendering (VR) imaging was performed with 64-slice multidetector computed tomography (MDCT) equipment in a patient with CBA and bronchocele. 3D VR images clearly revealed branching nonenhancing tubular structure and the adjacent lung with features of air trapping. A diagnosis of bronchocele was made radiologically. We report a case of bronchocele documented by 3D image reconstruction and VR images using 64-slice MDCT. In this article we report that, the radiologic findings of the broncocele can be shown more clearly with 3D VR technique than standart CT imaging.

Key Words: Lung; bronchi; tomography, spiral computed

ÖZET Konjenital bronş atrezisi (KBA) nadir görülen bir akciğer anomalisidir. Proksimal segmental veya subsegmental bronkusun konjenital tıkanıklığı ve distal yapıların normal gelişmesi sonucu oluşur. Tıkanıklık distalinde bronş içerisinin mukus ile dolması sonucunda bronkosel gelişir. KBA ve bronkosel bulunan bir hastaya 64 dedektörlü çok kesitli bilgisayarlı tomografi (ÇKBT) cihazı ile üç boyutlu hacim görüntülemesi (3D VR) yapıldı. Bu üç boyutlu hacim görüntüleri çok net bir şekilde bronkosele ait tubuler yapıları, kontrast maddeye gerek kalmadan dalları ile birlikte çevresindeki akciğerin hava hapsi alanlarını da gösterdi. Bronkosel tanısı radyolojik olarak konuldu. Bu makalede 64 dedektörlü ÇKBT cihazı ile üç boyutlu hacim görüntüleri elde edilen bir bronkosel olgusunu sunuyoruz. Bu makalede, bronkoselin radyolojik bulguları 3D VR yöntemiyle, standart BT incelemesinden çok daha net bir şekilde gösterilebildiği bildirilmiştir.

Anahtar Kelimeler: Akciğer; bronş; tomografi, spiral bilgisayarlı

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Congenital bronchial atresia (CBA) is a rare congenital abnormality of the lung first described by Falor and Kyriakides in 1949.[1] It results from a congenital focal obliteration of a proximal segmental/sub-segmental bronchus with normal development of distal structures. Because of proximal bronchial stenosis, the distal bronchi fill with mucus and form a bronchocele.[2] Computed tomography (CT) has been advocated as a valuable noninvasive modality in the diagnosis of CBA and bronchocele.[2-4] The multidetector computed tomography (MDCT) is consideredas a dramatic

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development in CT imaging that has direct implications in the three dimensional (3D) imaging of various systems.[2,5] This technique allows a precise evaluation of the vascular, bronchial when and parenchymal structures especially, additional volume rendering (VR) images are obtained.[6,7] In this case report, we presented the findings of 3D MDCT and VR images in of a patient with bronchocele. We report, to our knowledge, the first case of bronchocele documented by 3D image reconstruction and VR imaging with 64-slice MDCT, in this article.

CASE REPORT

A 29-year-old man complained of chest pain and cough. Laboratory data included a white blood cell count of 8800/mm^3. Electrocardiogram was normal. A chest radiograph obtained in inspiration showed a shadow of a mass in the right lower lobe. Contrast enhanced 3D MDCT was performed with a 64-slice scanner (Siemens Sensation 64, Erlangen, Germany). One hundred milliliters of iodinated contrast medium (100 ml of Ultravist, Germany) was injected at a rate of 4 ml/s, and after a delay of 15 s, a multislice acquisition was obtained from the aortic arch to the pulmonary basis with a scan time of 12 s, a slice thickness of 1 mm, and 1 mm intervals between slices. The volume rendering (VR) and maximum intensity projection (MIP) techniques were used. The MIP and 3D VR images clearly revealed branching nonenhancing tubular structure and the adjacent lung with features of air trapping seen as an area of hypertranslucency around the affected bronchi in the right lower lung (Figure 1,2). A diagnosis of bronchocele was made radiologically. At thoracotomy, the case showed subsegmental bronchial atresia with regional bronchocele and the focal hyperinflation with air trapping as compared with normally ventilated adjacent regions. Pathological diagnosis was made by findings of the resected specimen with distal mucus-filled bronchocele surrounded by hyperinflated lung parenchyma.

DISCUSSION

The bronchocele (bronchial mucocele) is develops gradual accumulation of mucus in the distal portion of obstructed bronchial tree. The causes of the occlusion may be congenital structural defect of the

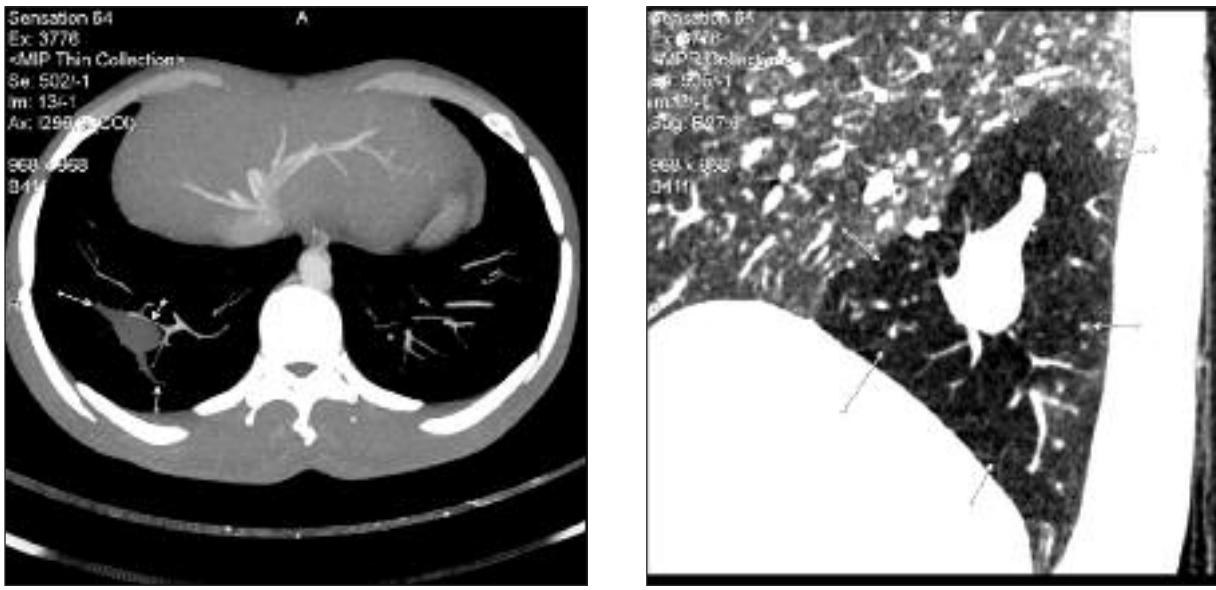

FIGURE 1: Pulmonary CT MIP images. A: Mediastinel window of axial MIP image showed a branching nonenhancing tubuler structure (arrows) in the lower lob of the right lung. B: Pulmonary window of sagittal MIP image revealed a tubular structure and the adjacent lung with features of air trapping (arrows) in the lower lob of the right lung.

A

B

C

FIGURE 2: Pulmonary CT, 3D VR images. A: Pulmonary window of sagittal VR image revealed a tubular structure and the adjacent lung with features of air trapping seen as an area of hypertranslucency around the affected bronchi (arrows) in the lower lob of the right lung. B,C: Mediastinel window of coronal VR images showed a branching nonenhancing tubuler structure (arrows) in the lower lob of the right lung.

bronchus, cicatrical shrinkage of the bronchial lumen, neoplasm and so on. While the lober bronchial atresia causes invariably atelectasis, segmental or subsegmental bronchial atresia may not cause any change in volume of the involved lung segment or subsegment. Most of the bronchoceles due to bronchial atresia show a striking degree of focal hyperinflation in the involved area because of the presence of collateral ventilation and check valve mechanism of the involved airways.[3,8] Most patients are asymptomatic at the time of diagnosis. However, they can present with dyspnea, pneumonia and bronchial asthma.[9]

Bronchial atresia is the second most common congenital malformation of the tracheo-bronchial tree.[8] The left upper lobe is involved in 64% of cases, the left lower lobe in 14% and the right middle and lower lobes in 8% of cases.[10] It usually involves a single lung segment although multiple lung segment involvement has been reported.[2,9]

Our patient had a bronchocele located in the rarest site, the right lower lobe.

CT is a very sensitive method for demonstrating the typical features of bronchocele and CBA. The pathognomonic feature is that of branching nonenhancing tubular structure representing the bronchocele.[11] This is characteristically surrounded by hyperinflation, representing air trapping.[2,12] Our case demonstrated both of these features in the MIP and 3D VR images. With use of contrast, CT scanning has been reported to rule out a vascular abnormality, making angiography unnecessary, and virtual CT bronchography has also been used for the evaluation of congenital tracheobronchial lesions.[3,13] In our case, contrast enhanced 3D MDCT images helped to distinguish the bronchocele from intrapulmonary vascular structures (Figure 1). In this case, the MIP and 3D VR images successfully depicted the bronchocele as a branching nonenhancing tubular structure and the adjacent lung with features of air trapping was seen as an area of hyperinflation around the affected bronchi. This is the pathognomonic finding of CBA and should suggest the diagnosis of bronchocele.[11]

MDCT, new imaging technique, has a high acquisition speed and probably more importantly, it acquires volume data instead of individual slice data. These two factors, together with thin section slices, enable a new technique to provide almost isotropic data that can be arranged in different planes without compromising the spatial resolution of the original axial images. The MDCT makes it possible to examine the entire lung with thin slices during optimal enhancement in a single breath hold, allowing better depiction of the pulmonary vascular and bronchial tree. MDCT 3D reconstruction and VR images of the lung may give the thoracic surgeon a clear-cut idea of the segment involved and how to plan the surgical approach.[2]

The 3D MDCT imaging is a rapidly evolving technique in the imaging of the pulmonary system. The main disadvantage of MDCT is the limited access to suitable MDCT technology. In this case, the 3D MDCT and VR techniques allowed a complete evaluation of the bronchocele. The result of this case suggests that pulmonary 3D image reconstruction and VR images using 64-slice MDCT in the bronchocele are feasible and can depict the bronchocele in encouraging detail.

In conclusion, this case report indicates that pulmonary 3D reconstruction and VR techniques with 64-slice MDCT are fast and accurate techniques for delineation of the bronchocele. The bronchocele as a branching nonenhancing tubular structure and the adjacent lung with features of air trapping seen as an area of hyperinflation around the affected bronchi can be visualized clearly with 3D image reconstruction and VR imaging using 64-slice MDCT.

REFERENCES

1. Falor WH, Kyriakides AH. Ectopia bronchi. J Thorac Surg 1949;18(2):252-60.
2. Abubacker S, Al Khulaifi Y, Shenoy JN. Congenital bronchial atresia: CT- 3D image reconstruction and virtual navigation. Kuwait Medical Journal 2006,38(3):238-40.
3. Morikawa N, Kuroda T, Honna T, Kitano Y, Fuchimoto Y, Terawaki K, et al. Congenital bronchial atresia in infants and children. J Pediatr Surg 2005;40(12):1822-6.
4. Gaeta M, Vinci S, Minutoli F, Mazziotti S, Ascenti G, Salamone I, et al. CT and MRI findings of mucin-containing tumors and pseudotumors of the thorax: pictorial review. Eur Radiol 2002;12(1):181-9.
5. Türkvatan A, Akdur PÖ, Akgül A, Ölçer T, Cumhur T, Duru E. [Prevalence of incidental extracardiac findings on multidetector computed tomographic coronary angiography]. Turkiye Klinikleri J Med Sci 2009;29(1):169-75.
6. Baydın M, Ceyhan M, Tanyeri B, Sungur M, Elmalı M, Tokatlıoğlu O. [A case of double aortic arch diagnosed by multidetector computed tomography]. Turkiye Klinikleri J Pediatr 2008;17(1):59-62.
7. Burrill J, Dabbagh Z, Gollub F, Hamady M. Multidetector computed tomographic angiography of the cardiovascular system. Postgrad Med J 2007;83(985):698-704.
8. Remy- Jardin M, Remy J, Ribet M, Gosselin B. Bronchial atresia: diagnostic criteria and embryologic considerations. Diagn Interv Radiol 1989;1(1):45-51.
9. Jederlinic PJ, Sicilian LS, Baigelman W, Gaensler EA. Congenital bronchial atresia. A report of 4 cases and a review of the literature. Medicine (Baltimore) 1987;66(1):73-83.

10. Kinsella D, Sissons G, Williams MP. The radiological imaging of bronchial atresia. Br J Radiol 1992;65(776):681-5.

11. Haller JA Jr, Tepas JJ 3rd, White JJ, Pickard LR, Robotham JL. The natural history of bronchial atresia. Serial observations of a case from birth to operative correction. J Thorac Cardiovasc Surg 1980;79(6):868-72.

12. Beigelman C, Howarth NR, Chartrand-Lefebvre C, Grenier P. Congenital anomalies of tracheobronchial branching patterns: spiral CT aspects in adults. Eur Radiol 1998;8(1):79-85.

13. Remy-Jardin M, Remy J, Artaud D, Fribourg M, Naili A. Tracheobronchial tree: assessment with volume rendering--technical aspects. Radiology 1998;208(2):393-8.