

1

가 , , 가 .

60% (1). CT 40 (2). (Fig. 3).

가 , , 가 . 가 가

(Tracheobronchomegaly, Mounier-Kuhn Syndrome)

10 - 12 cm (carina) (Fig. 1).

CT 1 - 3 mm (Fig. 2).

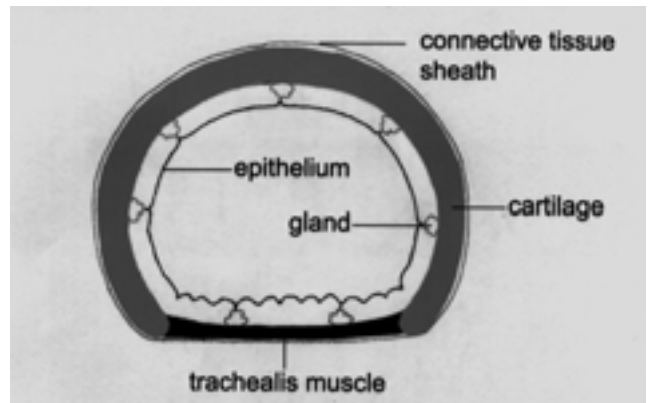


Fig. 1. A schematic drawing of normal trachea.

Ehlers - Danlos

(2).

(3).

(Fig. 4).

2.4 cm,
(3).

2 cm

2.3 cm

3 cm,

saber - sheath

(Tracheobronchopathia

Osteochondroplastica)

(4).

CT

(Fig. 5).

(Relapsing Polychondritis)

acid mucopolysaccharide
가

(5).

50%

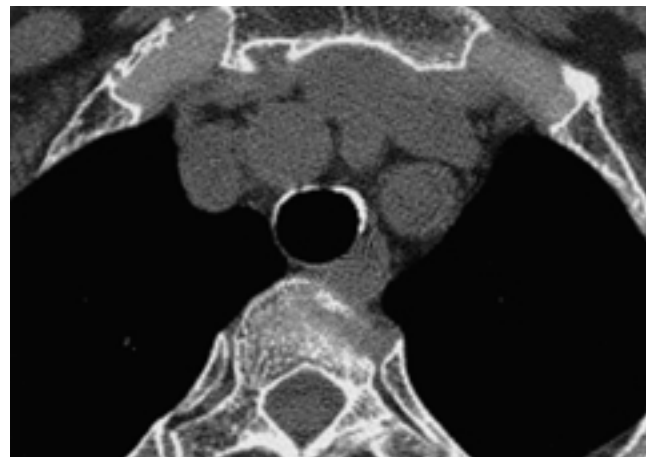


Fig. 3. A 67-year-old woman with dense calcification of tracheal cartilage. High-resolution CT scan shows calcified cartilage. Posterior tracheal membrane appears thin and uncalcified.



A

Fig. 2. Cross sectional shape of normal trachea in healthy person.

A. Inspiratory high-resolution CT scan shows slightly dense, horseshoe-shaped tracheal cartilage supporting anterior and lateral tracheal walls. Mucosa and submucosa internal to cartilage are not seen on CT scan. Posterior tracheal membrane is relatively thin.

B. Expiration results in anterior bowing of posterior tracheal membrane with a decrease in sagittal diameter.



B

lacunar 가 (6).

(5).

. CT

(Amyloidosis)

. 10 - 20%

(Fig.

(7).

50%

6).

가

(7).

. CT

(

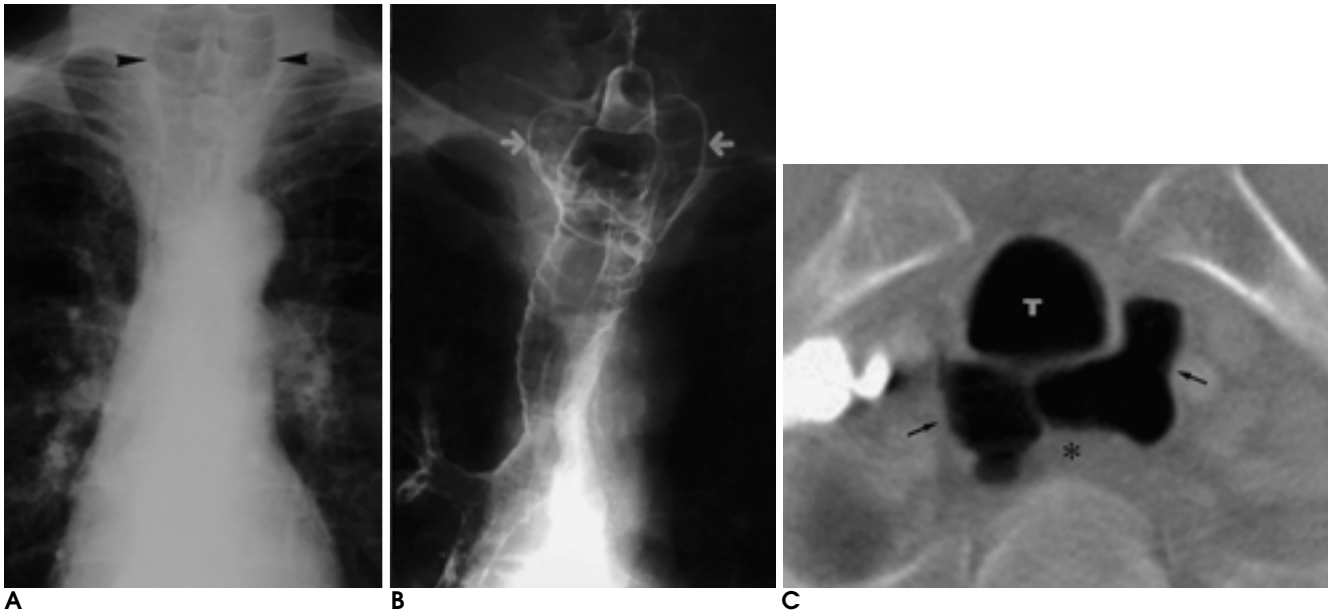


Fig. 4. Tracheobronchomegaly in a 51-year-old man who presented with recurrent pneumonia.
A. Chest PA shows marked dilatation of the trachea with outbulging appearance (arrowheads).
B. Tracheogram with barium reveals tracheal luminal dilatation and diverticula (arrows).
C. CT scan demonstrates multiple saccular outpouching (diverticula) of posterior tracheal wall (black arrows). T = trachea, asterisk(*) = esophagus.

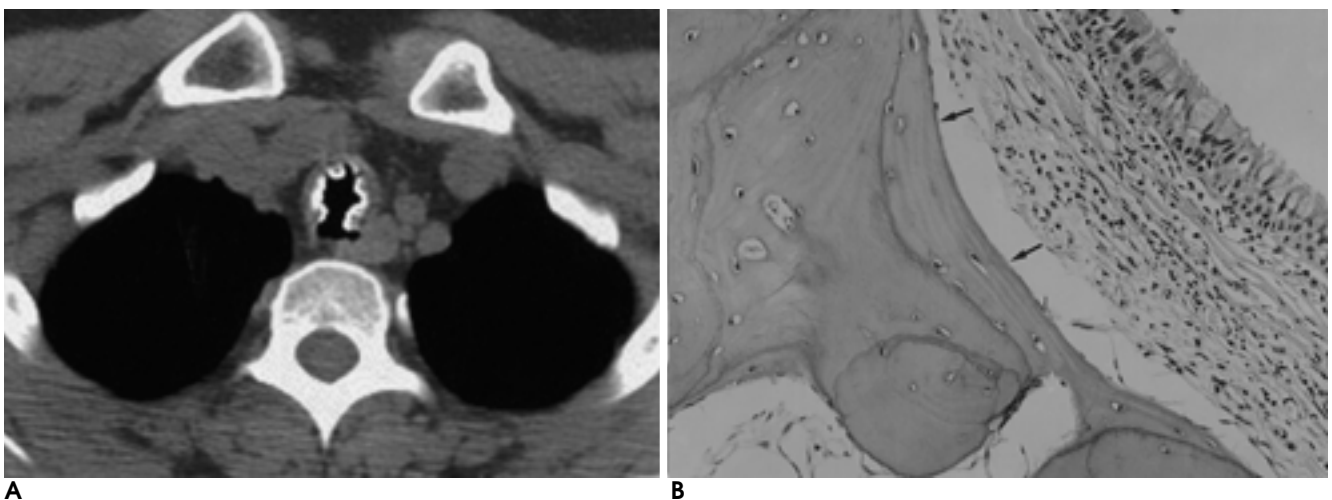


Fig. 5. A 42-year-old woman with tracheobronchopathia osteochondroplastica.
A. CT scan demonstrates calcified nodules protruding into tracheal lumen. Note sparing of the membranous posterior wall. Both main bronchus are also involved (not shown here).
B. Specimen histology (hematoxylin-eosin stain, $\times 200$) shows mature bone formation within submucosal layer (arrows).

)
(Fig. 7).

(*Wegener's Granulomatosis*)

(6).

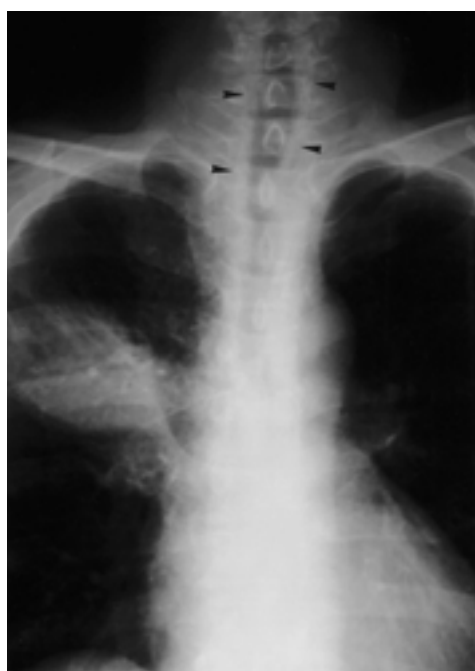
가 . CT

(Fig. 8).

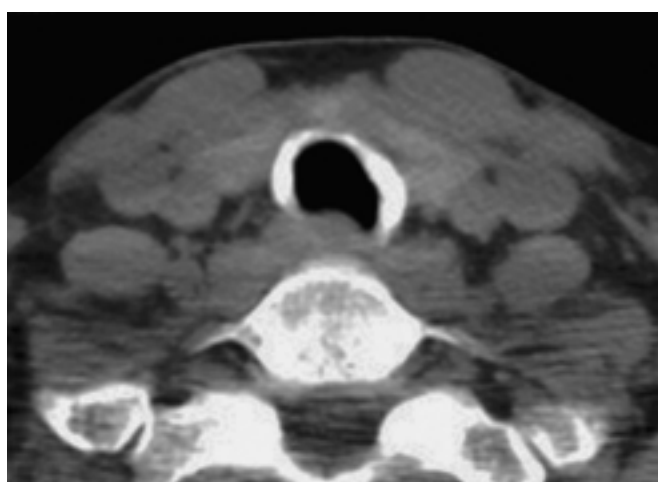
(*Tracheobronchial Tuberculosis*)

10 - 20%

(8).



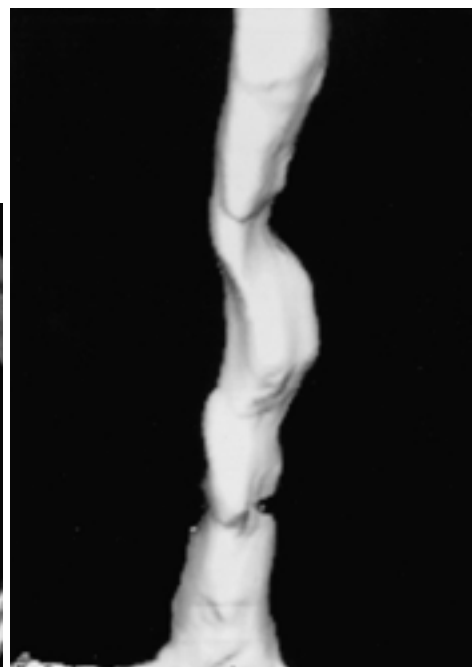
A



B



C



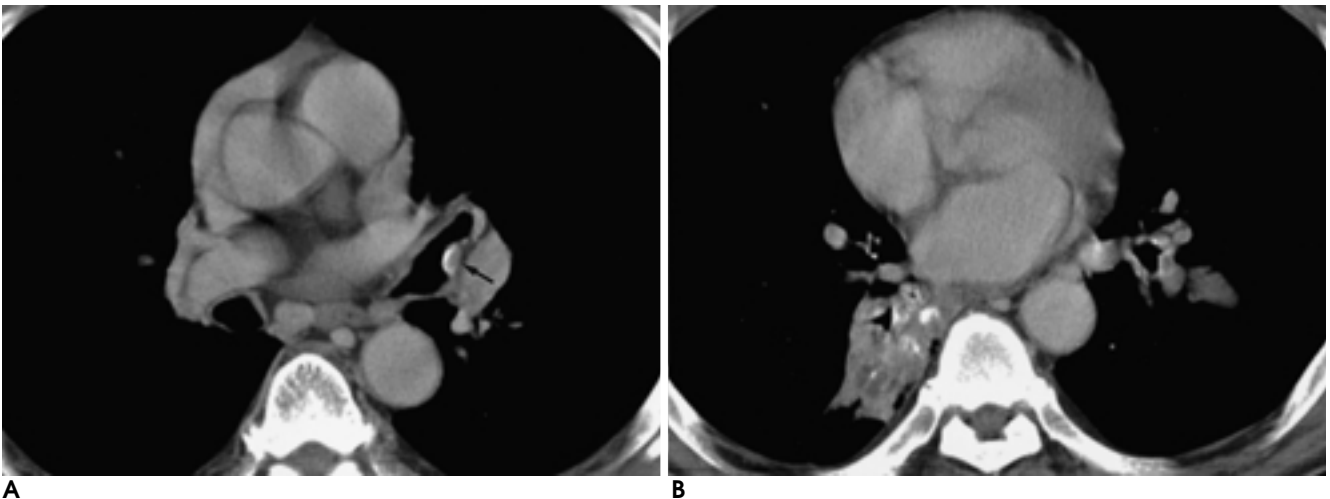
D

Fig. 6. A 48-year-old man with relapsing polychondritis. He had recurrent episodes of arthritis and physical examination revealed destruction of auricular cartilage.

A. Chest PA shows diffuse wall thickening and deformity of the trachea (arrowheads).

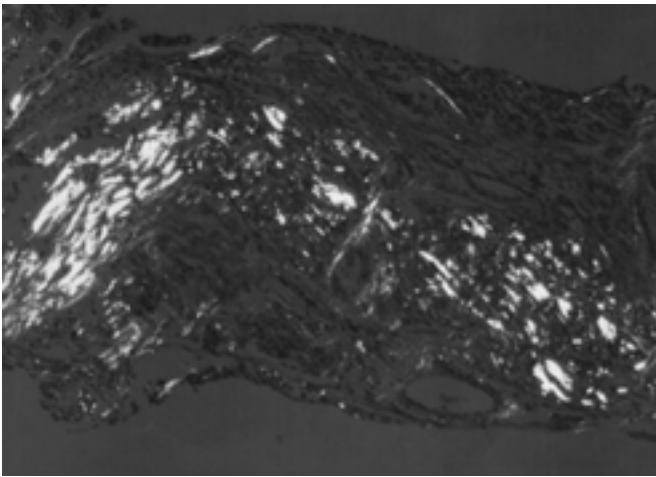
B, C. CT scan of the trachea and main bronchi shows thickening and calcification of the cartilage. Note lung cancer in right upper lobe.

D. Shaded-surface-display three dimensional image demonstrates diffuse luminal narrowing and deformity.



A

B

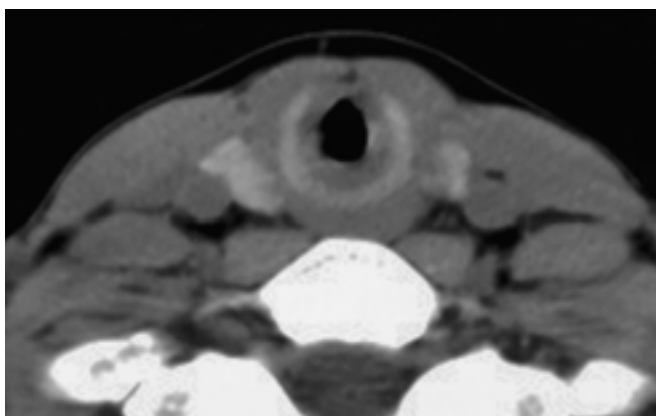


C

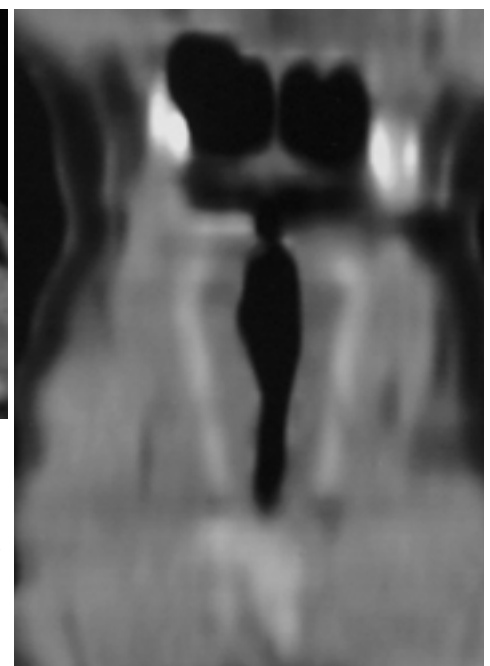
Fig. 7. Tracheobronchial amyloidosis in a 63-year-old man. He had blood-tinged sputum and dyspnea for four months.

A, B. CT demonstrates diffuse bronchial wall thickening with concentric calcification. A submucosal nodule is noted in posterolateral wall of left upper lobe bronchus (arrow in A). Smooth wall thickening of distal trachea is also noted (not shown here).

C. Under polarized light, apple-green birefringence of amyloid is noted within biopsy specimen (Congo red stain, $\times 200$).



A



B

Fig. 8. Tracheal involvement of Wegener's granulomatosis in a 19-year-old girl. Diagnosis was established from histologic examination of tissues obtained from the trachea, kidney and skin.

A. CT scan at the level of subglottic trachea reveals circumferential thickening of the wall.

B. Coronal reformatted image shows diffuse thickening of the tracheal wall.

:

(8).

,
CT

, 가 *Saber-sheath* (*Saber-sheath trachea*)

(8) (Fig. 9).

2/3

saber - sheath

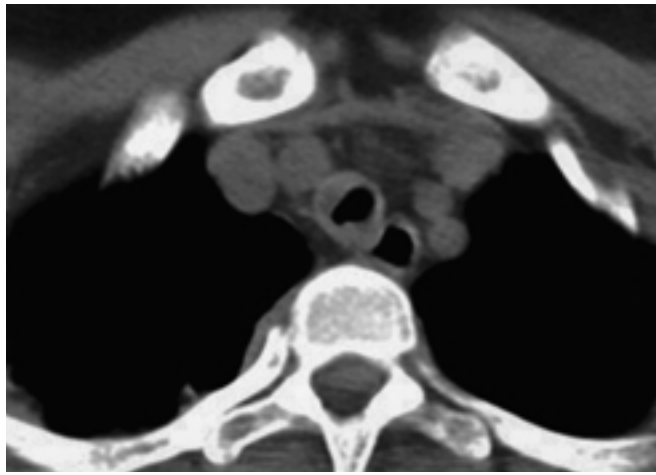
가

(Fig. 11).

(Fig. 10).

3 cm

(9).



A

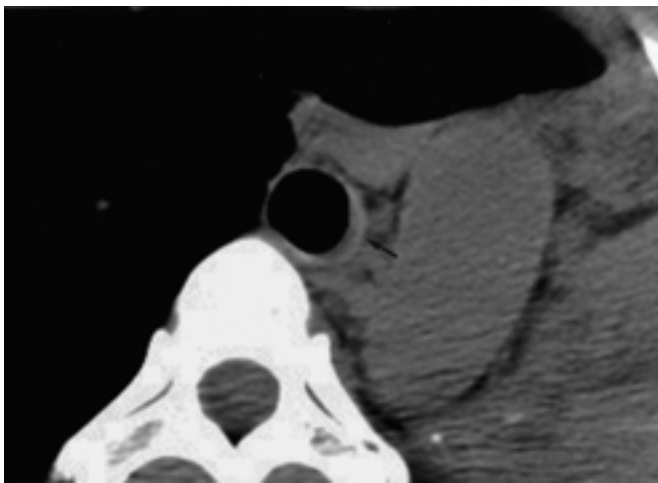


B

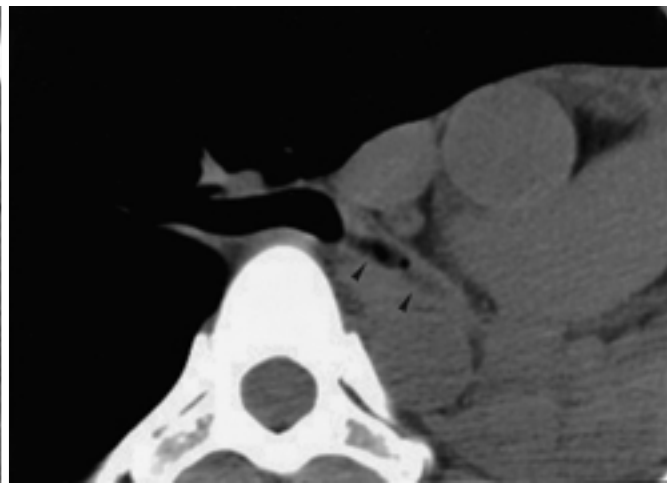
Fig. 9. Active caseating tracheobronchial tuberculosis in a 22-year-old woman. Bronchoscopic biopsy revealed chronic granulomatous inflammation with caseation necrosis.

A. CT scan at the level of thoracic inlet shows irregular wall thickening and luminal narrowing of the trachea.

B. Three dimensional CT scan demonstrates a long segmental involvement of the distal trachea. Right main bronchus is also stenotic (white arrow).



A



B

Fig. 10. Fibrotic stage of tracheobronchial tuberculosis in a 23-year-old woman. She had a history of prior antituberculous therapy. Acid-fast-bacillus staining and culture of bronchial aspirate were negative.

A, B. CT scan shows mild wall thickening of the distal trachea (arrow) and diffuse luminal narrowing of the left main bronchus (arrowheads). The left lung is collapsed.

CT
(Tracheomalacia)

가

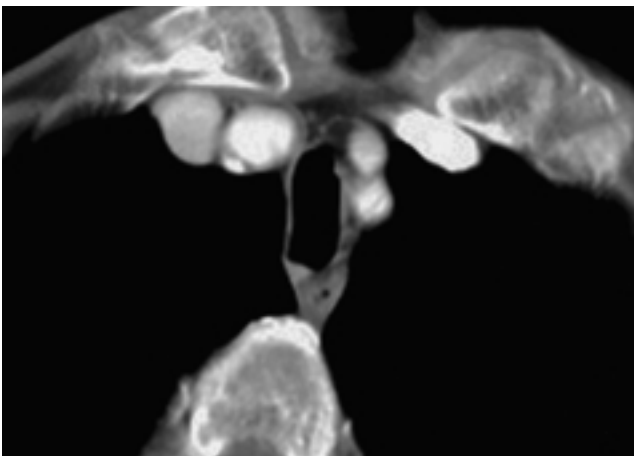


Fig. 11. A 72-year-old man with history of chronic obstructive pulmonary disease. Translateral narrowing of trachea below thoracic inlet, without thickening of tracheal wall, is typical of saber-sheath trachea.

CT
70%

(Tracheal Stenosis)

(8).

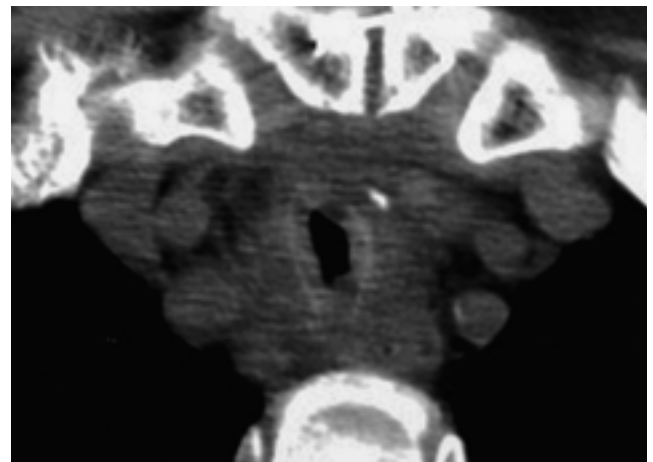
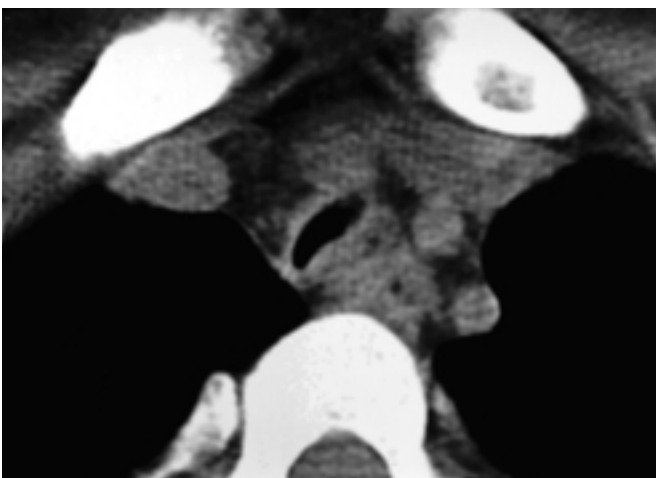


Fig. 13. Acute tracheal stenosis due to granulation tissue in a 29-year-old man. He was intubated for three weeks due to head trauma. Bronchoscopic biopsy revealed granulation tissue.

CT scan shows narrowing of tracheal lumen by soft tissue increase inward to tracheal cartilage and thickening of posterior membrane. The cartilage appears normal in shape.



A



B

Fig. 12. A 36-year-old man with tracheomalacia after prolonged intubation.

CT scan obtained after forced expiration (A) reveals marked collapse and abnormal decrease in cross sectional area compared with inspiration (B) (in this case 72%).

가 , 가 가
(6). CT
가
가
1.5 - 2.5 cm . CT (Tracheal Diverticulum)

(2, 9) (Fig. 13, 14). CT 가 (10). saber -



Fig. 14. Chronic tracheal stenosis after intubation in a 37-year-old man.
A. CT scan through extrathoracic trachea shows severe narrowing with collapse of the cartilage.
B. Sagittal reformatted image demonstrates focal, circumferential narrowing of tracheal lumen (arrows).

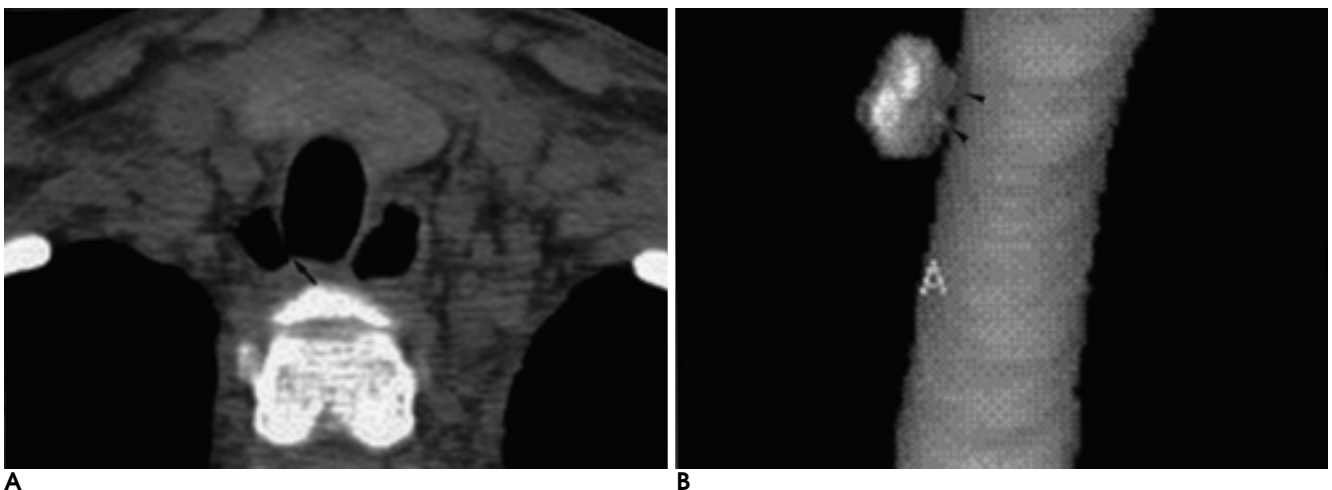


Fig. 15. Tracheal diverticulum in a 22-year-old man. He has suffered from prolonged, severe cough due to bronchial compression by thymic lymphoma.
A. Axial CT scan at the level of thoracic inlet shows right paratracheal air cyst with communicating channel (arrow) to tracheal lumen.
B. Anterior view of shaded-surface-display 3D image of the trachea demonstrates diverticulum and its communication with the tracheal lumen (arrowheads).

sheath

가

가

CT
(Fig. 15).

1. Stern EJ, Graham CM, Webb WR, Gamsu G. Normal trachea during forced expiration: dynamic CT measurements. *Radiology* 1993; 187:27-31
2. Webb EM, Elicker BM, Webb WR. Using CT to diagnose nonneoplastic tracheal abnormalities: appearance of the tracheal wall. *AJR Am J Roentgenol* 2000;174:1315-1321
3. Shin MS, Jackson RM, Ho KJ. Tracheobronchomegaly (Mounier-Kuhn syndrome): CT diagnosis. *AJR Am J Roentgenol* 1988;150: 777-779

4. Onisuka H, Hirose N, Watanabe K, et al. Computed tomography of tracheopathia osteoplastica. *AJR Am J Roentgenol* 1983;140:268-270
5. Mendelson DS, Som PM, Crane R, Cohen BA, Spiera H. Relapsing polychondritis studied by computed tomography. *Radiology* 1985; 157:489-490
6. Kwong JS, Muller, NL, Miller RR. Diseases of the trachea and main-stem bronchi: correlation of CT with pathologic findings. *RadioGraphics* 1992;12:645-657
7. Urban BA, Fishman EK, Goldman SM, et al. CT evaluation of amyloidosis: spectrum of disease. *RadioGraphics* 1993;13:1295-1308
8. Moon WK, Im JG, Yeon KM, Han MC. Tuberculosis of the central airways: CT findings of active and fibrotic disease. *AJR Am J Roentgenol* 1997;169:649-653
9. Gamsu G, Webb WR. Computed tomography of the trachea: normal and abnormal. *AJR Am J Roentgenol* 1982;139:321-326
10. Goo JM, Im JG, Ahn JM, et al. Paratracheal air cysts in thoracic inlet: clinical and radiologic significance. *AJR Am J Roentgenol* 1999; 173:65-70

J Korean Radiol Soc 2002;47:269 - 277

Imaging Features of Nontumorous Conditions Involving the Trachea and Main-stem Bronchi¹

Kyungnyeo Jeon, M.D., Duk-Sik Kang, M.D., Kyungsoo Bae, M.D.

¹Department of Diagnostic Radiology, Kyungpook National University Hospital

A number of nontumorous diseases may affect the trachea and main-stem bronchi, and their nonspecific symptoms may include coughing, dyspnea, wheezing and stridor. The clinical course is often long-term and a misdiagnosis of bronchial asthma is common. The imaging findings of these nontumorous conditions are, however, relatively characteristic, and diagnosis either without or in conjunction with clinical information is often possible. For specific diagnosis, recognition of their imaging features is therefore of prime importance. In this pictorial essay, we illustrate the imaging features of various nontumorous conditions involving the trachea and main-stem bronchi.

Index words : Bronchi, diseases
Trachea, CT
Trachea, diseases
Trachea, stenosis or obstruction

Address reprint requests to : Kyungnyeo Jeon, M.D., Department of Diagnostic Radiology, Kyungpook National University Hospital, 50, Samduk-dong 2ga, Chung-gu, Taegu 700-412, Korea.
Tel. 82-53-420-5390 Fax. 82-53-422-2677 E-mail: knjeon@knu.ac.kr