# Relapsing polychondritis revealed by $^{18}$F-FDG and Al$^{18}$F-NOTA-FAPI-04 PET/CT

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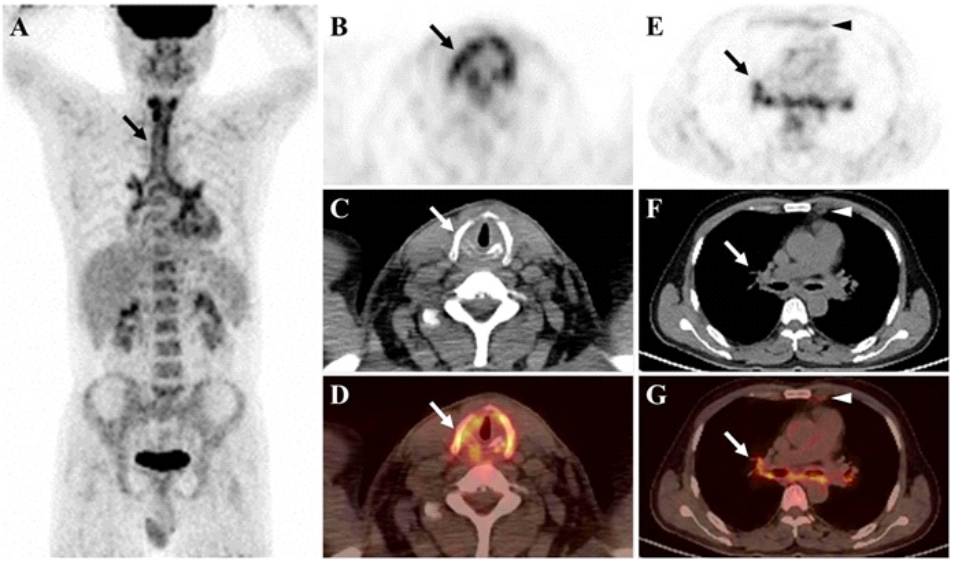


**Figure 1.** A 51-year-old man presented with sore throat, dry cough and fever about forty days. Serum C-reactive protein, erythrocyte sedimentation rate and leukocyte count were 228.65mg/L (reference, <1mg/L), 111.0MM/H (reference, <21MM/H) and 13.34×10$^9$/L (reference, 3.5-9.5×10$^9$/L), respectively. Rheumatoid factor level was normal. Tests for antinuclear antibodies, antineutrophil cytoplasmic antibodies and venereal diseases were negative. No obvious abnormalities were detected in chest computed tomography(CT), and laryngoscope only showed hyperemia and hypertrophy in the vocal cord. For pathogenic diagnosis, the patient underwent fluorine-18-fluorodeoxyglucose positron emission tomography/computed tomography ($^{18}$F-FDG PET/CT) exam, with maximum intensity projection (MIP) image (A, arrow) indicating moderate to intense uptake in the laryngeal cartilage andtracheobronchial tree. The maximum standardized uptake value (SUVmax) of laryngeal cartilage (B, C and D, axial PET, CT and fused PET/CT image, arrow) and tracheobronchial tree (E, F and G, axial PET, CT and fused PET/CT image, arrow) ranged from 3.8 to 9.3. In addition, mild $^{18}$F-FDG uptake was observed in partial costal cartilages (arrowhead in E, F and G), the SUVmax being 2.9. The above lesions were suggestive of the possibility of relapsing polychondritis.

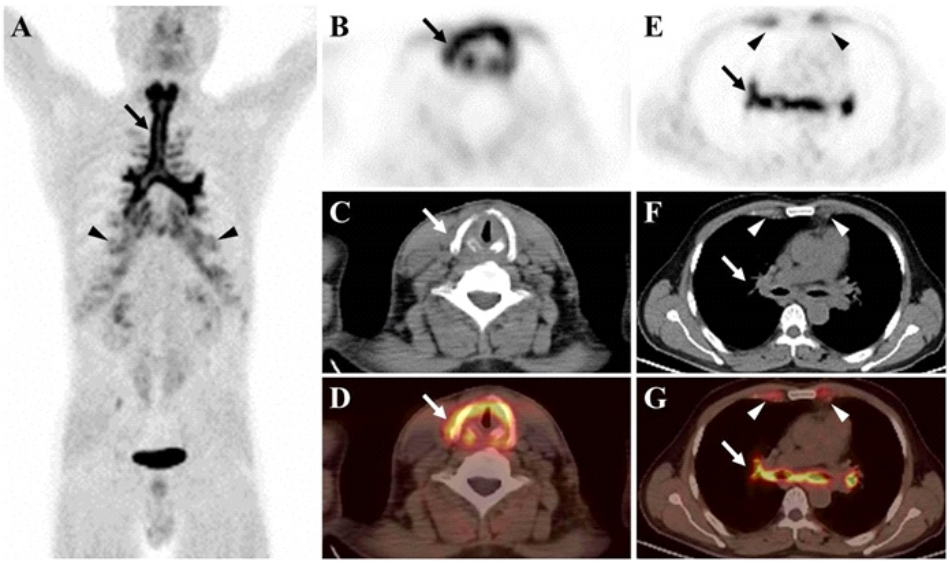


**Figure 2.** To identify any relevance to a malignant tumor and delineate the extent of the lesions, $^{18}$F-fibroblast-activation protein inhibitor (FAPI) PET/CT was performed three days later as a part of clinical trial approved by the institutional review board in our institution. The MIP image (A, arrow) showed more intense uptake in the laryngeal cartilage and tracheobronchial tree. The SUVmax of laryngeal cartilage (B, C and D, axial PET, CT and fused PET/CT image, arrow) and tracheobronchial tree (E, F and G, axial PET, CT and fused PET/CT image, arrow) were from 8.8 to 10.0. Besides, all costal cartilages (arrowheads in A, E, F and G) showed intense and symmetrical $^{18}$F-FAPI uptake, the SUVmax being 5.1.

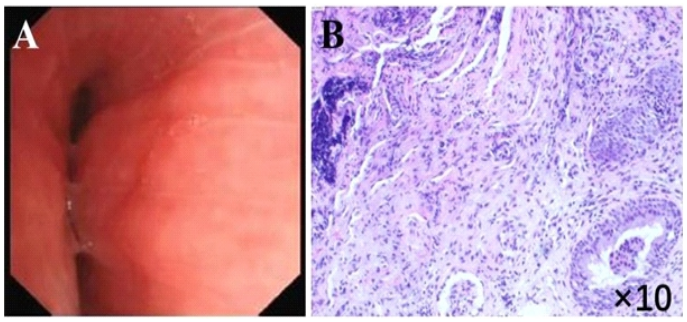


**Figure 3.** The bronchoscopy for the patient showed hypertrophy of tracheal mucosa, disappearance of cricoid cartilage, thickening of bronchial mucosa and narrowing of bronchial lumen (A, left main bronchus). Pathological examination of bronchial biopsy (B, hematoxylin-eosin stain, original magnifications×10) showed chronic mucosal inflammation with hyperplasia of interstitial fibrous tissue and infiltration of lymphocytes and plasma cells. PAS staining and Congo Red staining were negative. The patient was eventually diagnosed with relapsing polychondritis by revised criteria from Damiani and Levine (1979) [1] and received glucocorticoids and cyclophosphamide treatment followed with rapid improvement of the symptoms.

Fluorine-18-FDG PET/CT showed moderate to intense uptake in the laryngeal cartilage and tracheobronchial tree and mild uptake in partial costal cartilages. Al$^{18}$F-NOTA-FAPI-04 ($^{18}$F-FAPI) PET/CT was performed three days after $^{18}$F-FDG PET/CT as a part of clinical trial. The exam showed more intense uptake in above regions, including all costal cartilages. The patient was diagnosed with relapsing polychondritis (RP) according to revised criteria from Damiani and Levine.

Relapsing polychondritis is a rare autoimmune disease characterized by recurrent inflammation of cartilaginous structures and proteoglycan-rich organs, primarily affecting the cartilages of the ear, nose, larynx, tracheobronchial tree and ribs, and possibly non-cartilaginous tissues [2]. Previous studies showed the usefulness of $^{18}$F-FDG PET/CT in aiding the diagnosis of relapsing polychondritis and identifying multiple cartilage involved [3-5]. Recently, FAPI are considered as promising PET agents useful for diagnosing tumors [6-8], as well as for revealing nonmalignant diseases associated with tissue damage, remodeling or inflammation [9-10]. Therefore, $^{18}$F-FAPI PET/CT can also be applied in diagnosing cartilaginous inflammatory diseases. In this case, $^{18}$F-FAPI PET/CT revealed more lesions with better image contrast than $^{18}$F-FDG PET/CT and had a potential evaluation value for relapsing polychondritis.

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