The Journal of Laryngology and Otology
September 1992, Vol. **106**, pp. 845–848

Laryngo-tracheo-bronchopathia chondro-osteoplastica

L. Šmid, M.D., PhD., B. Lavrenčak, M.D., M. Žargi M.D., PhD. (Ljubljana, Slovenia)

Abstract
Two cases of laryngo-tracheo-bronchopathia chondro-osteoplastica (LTBCOP) are discussed regarding the pathogenesis of the disease. Our observations support the belief that chronic irritation of the perichondrium in the region of subglottis, trachea and bronchi plays an important role in the aetiology of this disease.

Introduction

Laryngo-tracheo-bronchopathia chondro-osteoplastica (LTBCOP) is a rare benign disease, which is characterised by bony and cartilaginous nodules within the submucosa, projecting into the lumen of the larynx, trachea and major bronchi. This entity was first diagnosed by Wilks (1857) and Rokitansky (1861). According to Muckleston (1909), the first person who noted the disease with a laryngeal mirror was von Schroetter in 1896.

Since 1910, when Aschoff introduced the term tracheopathia osteoplastica, various other names have been proposed (e.g. tracheitis chronica ossificans, echondrosis multiplex, tracheo-osteoma, tracheopathia osteochondroplastica, tracheobronchopathia osteochondroplastica). Paaske and Tang (1985) suggested the term LTBCOP, but they did not use it in the title of their article. Regardless of the fact whether the affected area involves only the trachea or also the bronchi and/or larynx, the typical histological picture renders the expression LTBCOP sensible and justified also in the cases when only individual areas are involved (for example trachea, trachea and bronchi, trachea and larynx).

The rarity of the disease, and the fact that in both our patients with LTBCOP the larynx was affected as well, represent the main reason for this report.

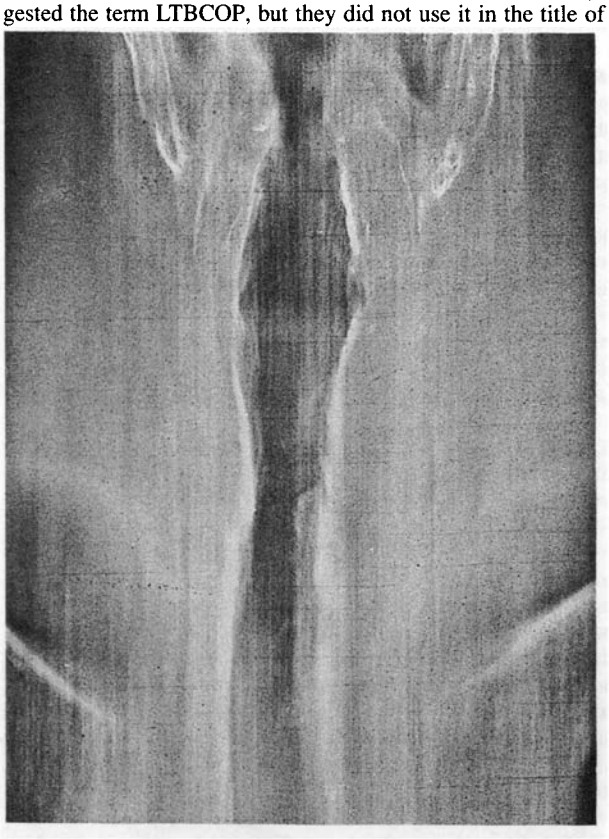

Fig. 1
Xeroradiogram of the larynx and trachea (Case 1) demonstrating irregular subglottic and tracheal outline.

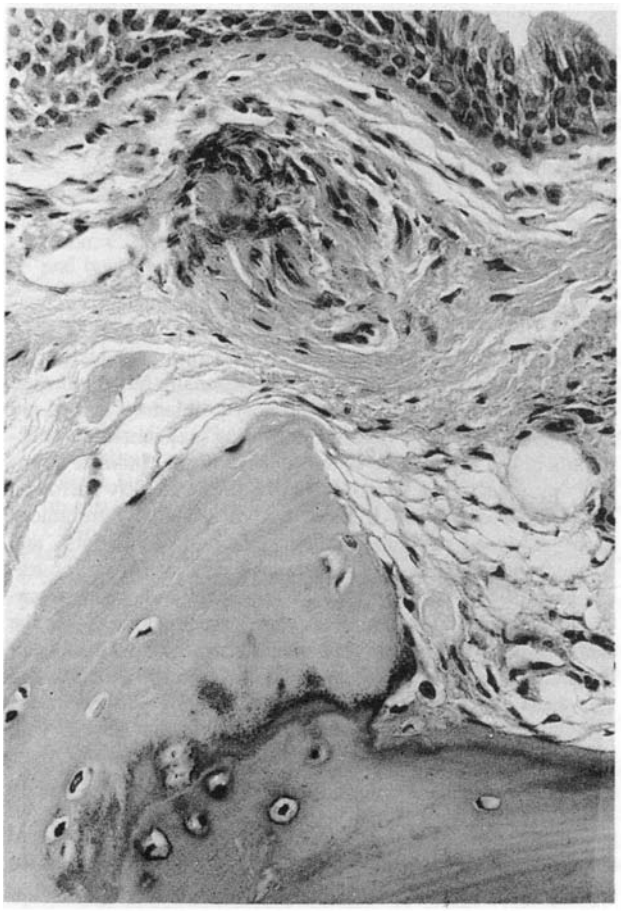

Fig. 2
Photomicrograph of a biopsy taken from the nodule of the tracheal wall showing mature bone and cartilage separated by fibrous inflammatory granulation tissue from the respiratory epithelium lining the trachea. H & E, original magnification, × 103.

Accepted for publication: 29 May 1992

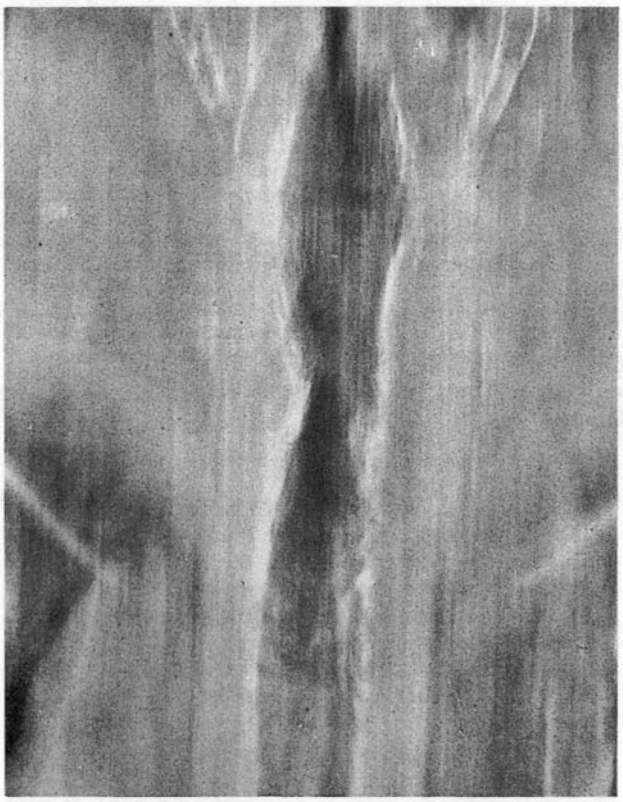

FIG. 3
Xeroradiogram of the same patient ten years later. Calcified nodules in the tracheal wall are more pronounced but without any obvious increase of airway reduction.

Case reports

Case 1

A 42-year-old male non-smoker with permanent occupational exposure to wood dust, presented at the University ENT department in Ljubljana in 1981 with a one year history of hoarseness of the voice, cough and occasionally blood-streaked sputum. He denied any other respiratory problems. Chest X-ray and other laboratory findings including calcium and phosphorus blood levels were within normal limits. Indirect laryngoscopy revealed an irregular surface to the slightly narrowed subglottic space below the swollen vocal folds. Xeroradiography disclosed moderate luminal reduction of subglottis and trachea with some inward projecting formations from the tracheal wall (Fig. 1). On direct laryngoscopy and tracheobronchoscopy, multiple hard nodules were seen projecting from the whole subglottic circumference and the tracheal walls, except in the membranous part. The nodules were firmly attached to the walls. Histological examination of the biopsied tissue revealed chronic inflammatory changes in the stroma with osteochondral areas in the submucosa (Fig. 2). After discharge from the hospital, the patient changed his working place to avoid further irritation and with time all his symptoms, except occasional hoarseness, disappeared. Ten years later repeated xeroradiography revealed only a slightly more narrowed lumen compared to that in 1981 (Fig. 3). Otherwise, the patient is doing well and is free of any respiratory problems.

Case 2

A 48-year-old female, non-smoker, with many years of occupational exposure to irritant gases, was admitted to the University ENT department in Ljubljana in 1982 with a six month history of repeated hoarseness of voice and difficult expectoration. Two years before admission, she had been operated on for an adenocarcinoma of the breast. Chest X-ray and all laboratory findings, including hormones, calcium and phosphorus blood levels were normal.

On indirect laryngoscopy, an irregular circular narrowing of the subglottic space was found. Xeroradiography revealed a significantly narrowed tracheal lumen with irregularly shaped walls. On direct laryngoscopy and tracheobronchoscopy severe stenosis, passable with a no.5 bronchoscope only, extending from the subglottis to 2 cm above the carina, was found. Subglottic and lateral tracheal walls were greyish, rough, rigid and very hard. Similar, but less pronounced changes were found also in both main bronchi. Histological examination of the stony hard tissue, biopsied from the tracheal wall, showed changes which were consistent with those typical for LTBCOP: close under the surface of metaplastic squamous epithelium irregularly shaped bony trabeculas were seen (Fig. 4). The patient was followed up regularly at three month intervals. Without significant deterioration of her respiratory functions, she died in 1984 from dissemination of her breast cancer.

Discussion

Nearly 350 cases of LTBCOP were published so far. Most of the reports do not mention the frequency with which this disorder affects the larynx (Nienhuis *et al.*, 1990). Among the cases where the larynx was involved, the disease was never found in the glottic or supraglottic region, but always in the subglottis. The only exception was a patient with an atypical picture of LTBCOP limited to the larynx only (Paaske and Tang, 1985). An explanation of the phenomenon that, in the case of the larynx, only the subglottic part is affected, is probably closely related to the aetiopathogenesis of LTBCOP.

Although several hypotheses have been described, the true aetiopathogenesis of LTBCOP is still unknown.

In 1863, Virchow described the disease as ecchondroses and exostoses from the normal tracheal rings.

Even *et al.* (1957) and Stain *et al.* (1976) mentioned a possible endocrinological role in the aetiology of LTBCOP. In our patient, who had LTBCOP diagnosed two years after her treat-

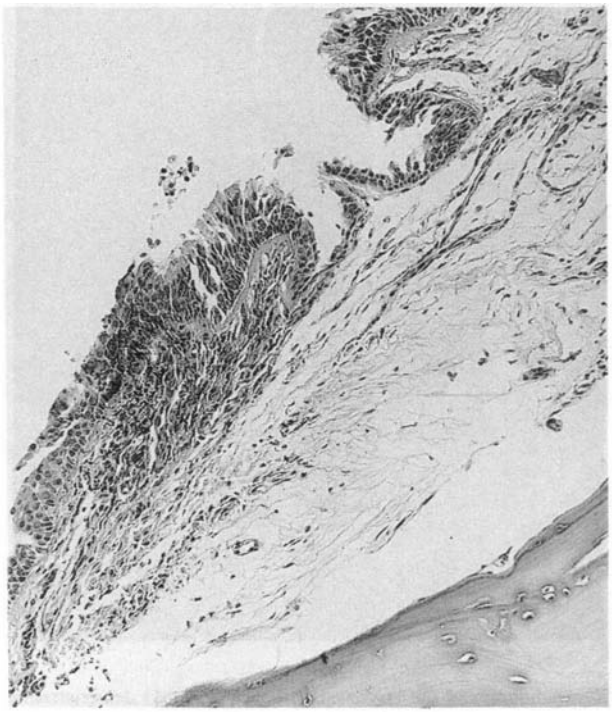

FIG. 4
Microscopy of part of a tracheal protuberance showing bone under the respitatory, partially metaplastic epithelium lining the tracheal wall (case 2).

https://doi.org/10.1017/S0022215100121061 Published online by Cambridge University Press

ment for breast carcinoma, the hormonal status was found to be within normal limits. Both our patients also presented with normal calcium and phosphorus levels, which supported the findings of Castella *et al.* (1981) who were not able to establish any direct correlation between calcium and phosphorus metabolism and LTBCOP.

According to the hypothesis suggested by Sakula (1968), Alroy *et al.* (1972) and Jones and Chateroi (1977), LTBCOP represents an advanced stage of amyloidosis. They support their hypothesis by the fact that, occasionally, foci of ossification can be seen in localised amyloidosis, the so-called amyloid tumours. During the past five years, four patients with localized amyloidosis of the upper respiratory tract have been treated at the University Department of Otorhinolaryngology and Cervicofacial Surgery in Ljubljana. However, the above hypothesis could not be confirmed as none of the histological specimens showed any new cartilage or bone formation. On the other hand, there was no evidence of amyloidosis found in the tissue samples taken from our two patients with LTBCOP. It seems really unlikely that amyloid deposits could induce LTBCOP and afterwards completely resolve, leaving behind only cartilaginous and bony nodules, as has been already pointed out by Pounder and Pieterse (1982).

According to Duchateau *et al.* (1975), LTBCOP may appear as a result of prolonged pressure exerted on the tracheal wall by an enlarged thyroid.

In some case reports, chemical fumes (Jackson, 1932) or oil vapors (Jepsen and Sorensen 1960) are suggested as possible aetiological factors. The prolonged exposure of both our patients to irritating substances and the significant improvement of symptoms, as well as only negligible progress of disease observed in our first case during the following 10 year period after the change of his working place indicate that the very exposure to chronic irritation has played a certain role in the onset of LTBCOP.

Aschoff (1910), Dalgaard (1947) and Pilis (1973) claim that LTBCOP related changes are due to cartilaginous or osseous metaplasia of the submucous connective tissue, which occurs as a result of prolonged exposure to irritants. The latter agents should be responsible for connective tissue differentiation into the bone or cartilage.

We believe that formation of new bone and cartilage could be explained as a reaction of the perichondrium exposed to protracted irritation. This can be supported by a number of facts:

— LTBCOP appears exclusively in the sites where the perichondrium is intimately related to the mucous membrane, i.e. in the trachea, bronchi, and subglottis. The parts without perichondrium under the mucosa (membranous part of the trachea) are not affected by the disease.

— Though rarely performed, pathohistological studies of serial sections of the trachea in autopsied patients with LTBCOP have shown that each nodule in the submucosa was connected with a corresponding tracheal ring from which it originated (Bowen 1959; Young *et al.*, 1980; Pounder and Pieterse, 1982). A biopsy performed on direct laryngoscopy or tracheobronchoscopy, which is often hardly feasible (Baird and Macartney, 1966; Castella *et al.*, 1981), does not enable the pathologist to either confirm or exclude the connection with cartilage on the basis of the material obtained and therefore the suggestion of a metaplastic origin of the cartilaginous or osseous tissue from the submucous connective tissue is questionable.

— Some of the published reports on LTBCOP point out the rigidity of the trachea and fixation of newly formed cartilaginous and/or osseous tissue on the tracheal wall (Pilis 1973; Castella *et al.* 1981); the same changes have been observed also in our two patients. On the other hand, no report has been found which described mobile nodules.

— The ability of perichondrium to form new cartilage which may afterwards undergo ossification, is well known and documented (Sohn and Ohlsen, 1974).

The question why, with such a high number of people exposed to irritating agents, the incidence of LTBCOP is so low has not yet been explained. However, considering that in many cases the course of the disease is asymptomatic (Duchateau *et al.*, 1975; Paaske and Tang, 1985), it is possible that the actual number of patients affected is higher than has been presumed so far. If both otorhinolaryngologists and chest specialists in their investigations (indirect and direct laryngoscopy, tracheobronchoscopy) were to pay more attention to otherwise minor changes in the region of subglottis, trachea and bronchi, which are clinically unsuspicious for malignant tumours it may be expected that the number of detected LTBCOP cases will increase.

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Address for correspondence:
Dr Lojze Šmid,
University Department of Otorhinolaryngology,
Zaloška 2,
61000 Ljubljana,
Slovenia.

Key words: Larynx; Trachea; Bronchi; Laryngo-trancheo-bronchopathia chondro-osteoplastica