QT-interval changes. Accordingly, coronary spasm due to hypocalcemia must be viewed as the most likely cause of the QT-interval changes, as well as the clinical and invasive findings. Calcium ions are necessary for both contraction and relaxation; they are essential in both the cardiac and systemic vasculature. Furthermore, spasms are known to be a sequel of hypomagnesemia, which, in turn, is often associated with hypocalcemia. Indeed, in our patient at the time of admission, magnesium depletion was also found (0.5 mmol/L), which, within a few days, returned to normal when clinical and ECG findings had resolved. Thus, coronary spasm in the clinical setting of hypocalcemia appears the most likely cause of the chest pain at admission, mimicking acute myocardial infarction. In contrast, both the initial clinical findings and the course of the disease rule out differential diagnostic considerations, such as prior coronary artery embolism, cardiomyopathy, or myocarditis.

There is controversy regarding the relationship between calcium concentration and left ventricular function, as well as the rapidity of reversal on elimination of the underlying electrolyte imbalance. Experimental data suggest more extensively depressed ventricular function with lower calcium concentrations. However, depression of left ventricular ejection does not appear to be a matter of extracellular calcium concentrations only. It also appears to be related to the duration of the imbalance, during which organic alterations may be incurred, to concomitant or underlying heart diseases, as well as to the rapidity of calcium concentration changes. If, as in the case of chronic heart failure, β-adrenergic-receptor down-regulation renders β-agonists ineffective, the contractile state may become almost exclusively dependent on extracellular calcium concentration. This, in turn, leads to rapid changes of left ventricular performance following acute changes of calcemia. On the other hand, isolated chronic hypocalcemia due to endocrine disorders leads to organic changes that need not be reversible, but leaves the β-adrenoceptor-dependent cardiac contractile state unaltered. Accordingly, little, if any, acute change in cardiac performance can be expected on repletion of calcium stores. This concept is also in keeping with the fact that clinically manifest heart failure is rarely observed in the stores. This concept is also in keeping with the fact that performance can be expected on repletion of calcium associated with hypocalcemia. Indeed, in our patient at the time of admission, magnesium depletion was also found (0.5 mmol/L), which, within a few days, returned to normal when clinical and ECG findings had resolved. Thus, coronary spasm in the clinical setting of hypocalcemia appears the most likely cause of the chest pain at admission, mimicking acute myocardial infarction. In contrast, both the initial clinical findings and the course of the disease rule out differential diagnostic considerations, such as prior coronary artery embolism, cardiomyopathy, or myocarditis.

In summary, in this case, an exacerbation of long-standing hypocalcemia led to suspicion of an acute or evolving myocardial infarction. There was no history of factors such as sepsis, acute pancreatitis, administration of radiopaque contrast media, cardiopulmonary bypass, transfusion of citrated blood, hemodialysis, or (para)thyroidectomy, all of which are known to have the potential to lower the calcium concentration. Accordingly, in this patient and others, management of the emergency situation will not only remain dependent on the rapidity with which complete blood chemistry results are available, but also the urgency with which severe cardiac disease must be confirmed or ruled out.

**REFERENCES**


**Laser Resection of a Pedunculated Tracheal Adenoma**

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We report a case of tracheal adenoma presenting as hemoptysis and reversible airflow obstruction in an ex-smoker. A questionable defect in the tracheal air shadow on a posteroanterior chest radiograph was shown on CT to be a pedunculated, mid-tracheal tumor. Two-stage bronchoscopic laser resection resulted in an apparently normal tracheal mucosa. Results of postresection spirometry were normal.

**Key words:** adenoma; laser; pedunculated; trachea

Pedunculated tracheal adenomas are extremely rare, and like bronchial adenomas, they may present with hemoptysis. In addition, because of their location in that

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part of the lower respiratory tract with the smallest aggregate cross-sectional area, if large enough they may produce airflow obstruction, breathlessness, and wheezing, suggesting airflow obstruction due to asthma or COPD. Preoperatively, there was β₂-agonist-reversible bronchial obstruction. After resection, there was no airflow obstruction, and the methacholine challenge test result was normal.

**Case Report**

The patient was a 65-year-old housewife who presented with a hemoptysis of about 100 mL over 2 successive days. She had a 30-pack-year history of smoking and had discontinued cigarettes 9 months earlier. The simple chronic bronchitis present while she was smoking had resolved.

For about 4 months, she had complained of gradually increasing exertional breathlessness, and for about 1 week, she had noted intermittent wheezing but no cough or sputum. Symptoms were unchanged on lying down, and she denied epistaxis, vomiting, or melena. There had been no bruising, petechia, or bleeding from any other orifice. Past illnesses included depression for which she had been taking amitriptyline for 4 years, osteoarthritis for which she was taking diclofenac, and one episode of phlebitis after the last of her four pregnancies 40 years earlier.

She denied weight loss or anorexia and had not been febrile. On physical examination, she looked well and was in no respiratory distress. She was not cyanotic, and there was no clubbing. Findings from head and neck examination were unremarkable. Her chest revealed good air entry bilaterally with no adventitious sounds. Results of cardiovascular examination were unremarkable. There was no hepatomegaly or splenomegaly or other abdominal masses, and no dependent edema was noted. There was no lymphadenopathy. Spirometry showed FEV₁/FVC of 1.0/2.01, which increased to 1.5/2.31 15 min after the inhalation of albuterol, 200 μg (predicted, 2.2/2.8; Fig 1).

**Radiology**

Plain chest radiographs showed a 2 × 3-cm well-defined nodule with an irregular outline in the trachea, the inferior margin of

![Figure 1](http://journal.publications.chestnet.org/pdfaccess.ashx?url=/data/journals/chest/21949/)

**Figure 1.** Left: spirometry before and after albuterol, 200 μg, shows reversible airflow obstruction. Right: spirometry is normal and unchanged postbronchodilator after resection of the tracheal tumor.

![Figure 2](http://journal.publications.chestnet.org/pdfaccess.ashx?url=/data/journals/chest/21949/)

**Figure 2.** Top: in the plain posteroanterior radiograph of the chest, the hemispherical soft tissue mass is seen in the lower tracheal air column on the left side just above the carina (arrows), while in the lateral plain radiograph of the chest (bottom), the lesion has a more nodular appearance as it rests in the lower portion of the trachea (arrow).
which almost reached to the carina. In both views, the lesion spanned almost the entire width of the tracheal lumen. The chest radiograph was otherwise unremarkable. The lung fields were unremarkable and normally expanded (Fig 2).

CT views demonstrated a correlating intralumenal defect in the trachea, the anterior margin of which extended diagonally across the trachea at approximately mid-lumen. The upper and lower margins of the lesion projected into the lumen in a finger-like fashion. The mass was of approximately uniform soft-tissue density and was not calcified (Fig 3). The patient was referred to the thoracic surgery department.

**Bronchoscopy and Laser Resection**

A rigid bronchoscope was passed into the trachea, revealing a large (approximately 1.5 cm in diameter) sessile polypoid tumor in the distal trachea affixed to the lateral wall just above the left mainstem bronchus (Fig 4).

Following intubation, the Nd-YAG laser was passed through a flexible fiberoptic bronchoscope. Using 50-W pulses at 0.2 s, approximately 5,000 J of energy was used to vaporize the tumor. At the termination of the procedure, approximately 1.2 mm of tumor projected into the lumen of the distal trachea for a distance of 1.5 cm, originating from the left lateral wall of the trachea.

Because a small amount of residual tissue remained after the first procedure, 6 days later the bronchoscope was again inserted transorally under local anesthesia, and 750 J was used to vaporize the leading edge of the base of the remaining sessile tumor. Because of difficulty dealing with the very acute angle of the left mainstem bronchus, the procedure had to be terminated and repeated 8 days later under general anesthetic. At that time the Nd-YAG laser was passed through an endobronchial tube, and 3,500 J was used to vaporize the residual tumor. At the end of the procedure, the airway appeared free of disease.

**Figure 3.** Left, center, right: at different levels of the CT examination of the trachea, the variable contour of the mass is noted as it projects into the tracheal lumen.

**Figure 4.** Tracheal tumor in situ. The tumor seemed to occupy more than half of the cross-section of the trachea.

**Figure 5.** Appearance of the trachea 3 months after resection of the tumor.
About 3 months later, the patient again underwent bronchoscopy under local anesthesia. There was no evidence of any endobronchial abnormality or scarring, and the site of the tumor appeared reepithelialized (Fig 5). Fourteen months later, the trachea again appeared completely normal.

Pathology

The specimen consisted of three polypoid portions of soft pale yellow and gray tissue measuring 1.3 × 1.0 × 0.7 cm, 1.5 × 1.2 × 0.5 cm, and 1.0 cm in diameter, respectively. Microscopically, the lesion was a papillary adenoma. It consisted of a complex branching fibrovascular stroma covered by a single layer of columnar epithelial cells (Fig 6). The cells were devoid of cilia. Very occasional mucous cells were interspersed with the columnar cells. The nuclei showed slight variation in size, with the occasional presence of small nucleoli. Mitoses were present but were very scanty and morphologically normal. The surface of the adenoma was covered by pseudostratified ciliated columnar epithelium with focal squamous cell metaplasia.

Discussion

The patient with this unusual tracheal adenoma presented with airflow obstruction of recent onset complicated by moderate hemoptysis. The clinical findings suggested the presence of asthma or COPD in a patient suspected of having bronchogenic carcinoma because of the smoking history. It is likely that the improvement of FEV1 and vital capacity after use of the bronchodilator albuterol is mainly a reflection of tracheal dilatation, which would tend to amplify capacity after use of the bronchodilator albuterol is mainly a focal squamous cell metaplasia. The preoperative symptoms of mild but variable dyspnea, cough, wheeze, and chest tightness disappeared postoperatively, and the methacholine challenge test result was normal, with a provocative concentration causing 20% fall of FEV1 of 16 mg/mL.

Benign epithelial neoplasms of the trachea and main bronchi are rare. They consist of surface epithelial neoplasms and tracheobronchial gland neoplasms. Surface epithelial neoplasms consist of squamous cell papillomas, transitional cell papillomas, and papillary adenomas.1 Benign tracheobronchial gland neoplasms usually form intraluminal polypoid lesions. The varieties that have been described include mucous gland (cell) adenoma,2–3 cystadenoma,4 pleomorphic adenoma,4 and oxyphil adenoma.4 We are not aware of previous descriptions of tracheobronchial adenoma with a papillary structure. Bronchial gland cell-type adenocarcinomas that show endobronchial growth have been described in the segmental and subsegmental bronchi. However, unlike the present case, they show cellular polymorphism and atypia accompanied by an acinar, tubular, or cribriform growth pattern.5

A recent review of 3,937 patients with endobronchial tumors showed that 185 tumors (4.7%) were benign, and only 1 of these was an adenoma. Laser resection provided “very good” results in 115 of the benign tumors (62%), and “good” results in 70 benign tumors (38%). Fifty-four tumors (29%) were located in the trachea. Like our patient, the patients with tracheal tumors presented showing consequences of airway obstruction (cough, dyspnea, localized wheeze) and hemoptysis (rarely), or postobstructive pneumonia. According to the authors’ system of classification, results were “very good” if the tumor was completely removed with one session of laser bronchoscopy or “good” if more than one session was required.6 Thus, our case would fall into the latter category.

References