

Teflon laryngeal granuloma presenting as laryngeal cancer on combined positron emission tomography and computed tomography scanning

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Abstract

Background: Positron emission tomography with 18F-fluorodeoxyglucose (¹⁸FDG) has been increasingly used in the diagnostic investigation of patients with neoplasms of the head and neck. Positron emission tomography and computed tomography have also proven useful for surveillance of thyroid cancers that no longer concentrate radioiodine. However, certain benign or inflammatory lesions can also accumulate 18F-fluorodeoxyglucose and lead to misdiagnosis.

Objectives: We review and discuss the pitfalls of using positron emission tomography and computed tomography for surveillance of thyroid cancer.

Method: We present the case of a 48-year-old woman who was diagnosed with a laryngeal neoplasm on integrated positron emission tomography and computed tomography scanning, after a routine ultrasound demonstrated an enlarged thyroid nodule. On physical examination, she had a laryngeal mass overlying an immobile vocal fold. The mass was biopsied and found to harbour a Teflon granuloma.

Conclusions: Positron emission tomography positive Teflon granulomas have previously been reported in the nasopharynx and vocal folds, and should be considered in the differential diagnosis of patients who have undergone prior surgery involving Teflon injection. It is important for otolaryngologists and radiologists to recognise potential causes of false positive positron emission tomography and computed tomography findings, including Teflon granulomas.

Key words: Polytetrafluoroethylene; Granuloma; Positron Emission Tomography; Thyroid Gland; Vocal Cord Paralysis; Larynx Neoplasms

Introduction

Positron emission tomography (PET) with 18F-fluorodeoxyglucose has been increasingly used in the diagnostic investigation of patients with neoplasms of the head and neck. Combined PET and computed tomography (CT) scanning has the added advantage of providing a layer of anatomical data which facilitates surgical planning. More recently, physicians have been using combined PET and CT scanning not only in diagnosis but also in the surveillance of head and neck cancers and de-differentiated thyroid cancers.

Case report

A 48-year-old woman with a history of papillary thyroid cancer was referred to our clinic with recent onset of hoarseness and a suspicious laryngeal lesion.

Her endocrinologist had ordered a combined PET and CT scan to investigate a sustained elevation of her thyroglobulin level and an enlarged thyroid nodule, in light of a negative radioiodine scan. The integrated PET and CT scan had revealed an 18F-fluorodeoxyglucose avid lesion at the level of the right true vocal fold, suspicious for

laryngeal cancer (Figures 1a and 1c). No other 18F-fluorodeoxyglucose avid lesions had been seen. The CT portion of the scan had shown a mass at the level of the right vocal fold (Figures 1b and 1d).

Upon further questioning, the patient reported that she had undergone a thyroidectomy for papillary cancer 21 years ago, which resulted in unilateral vocal fold paralysis. Shortly after her initial surgery, she had undergone a medialisation procedure of her right vocal fold, using Teflon[®]. She had done well since that time.

Examination of the patient's neck revealed no significant neck masses or swelling.

Flexible laryngoscopy showed impaired right vocal fold motion, with a smooth, well circumscribed, 2 cm mass on the right aryepiglottic fold and false vocal fold (Figure 2).

Given the findings and the suspicious nature of the laryngeal lesion, the patient was taken to the operating theatre for direct laryngoscopy and biopsy of the lesion. The fragments of tissue exhibited a rubbery consistency, with a mixed dull and shiny component.

Histopathological examination demonstrated normal squamous epithelium overlying a marked foreign body giant cell

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Presented at the 2008 Annual Scientific Meeting of the Pennsylvania Academy of Otolaryngology Head and Neck Surgery, in Bedford Springs, Pennsylvania, USA, June 13–14, 2008.

Accepted for publication: 19 August 2008. First published online 31 October 2008.

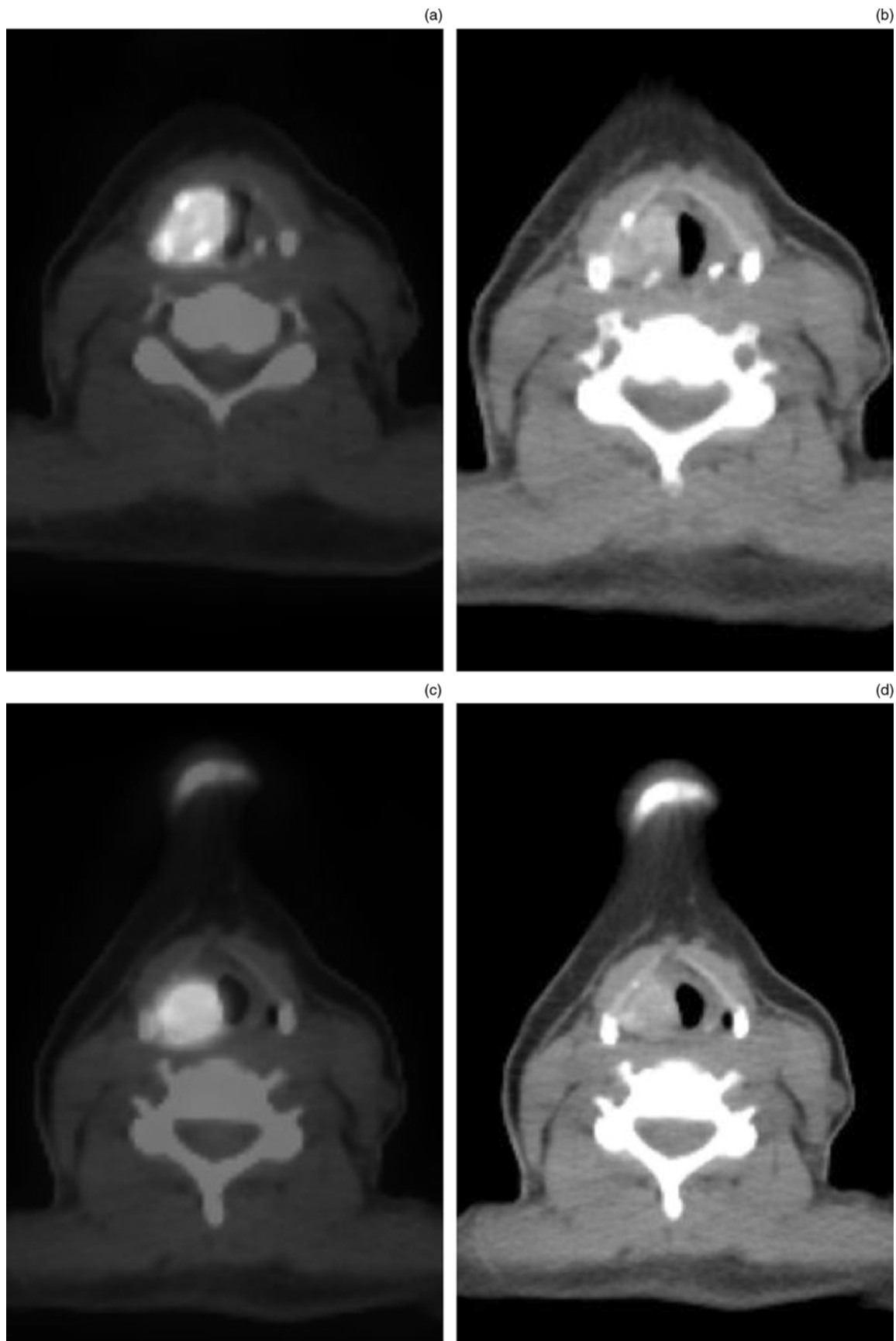


FIG. 1

(a), (c) Axial integrated positron emission tomography (PET) and computed tomography (CT) scanning images at the level of the larynx, showing a strongly ^{18}F -fluorodeoxyglucose avid, right-sided mass. (b), (d) Axial CT scan (without PET overlay) showing the lesion.

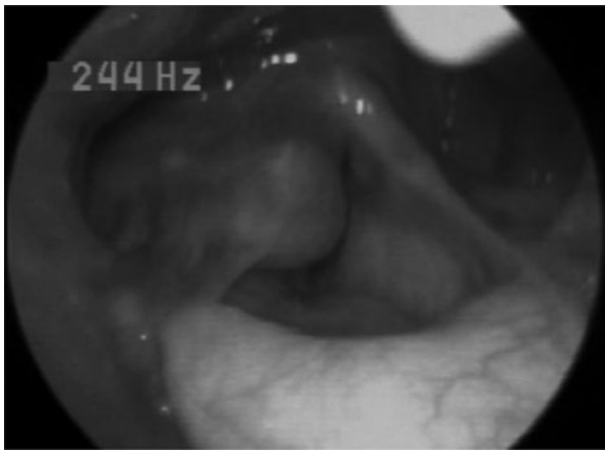


FIG. 2
Lesion seen on videostroboscopy.

reaction to exogenous material, consistent with a Teflon granuloma (Figures 3a and 3b).

Discussion

Positron emission tomography provides physiological and biochemical data regarding the patient's disease. Eighteen F fluorodeoxyglucose is distributed throughout the body on the basis of intracellular intake via glucose transporters or transport proteins. The degree of ¹⁸F-fluorodeoxyglucose uptake has been shown to be strongly related to neoplastic growth, due to the overexpression of glucose transport proteins and certain key enzymes.¹ A traditional PET scan lacks the anatomical detail needed for operative planning, but an integrated PET and CT scan allows the surgeon to localise the disease more precisely. Recently, ¹⁸F-fluorodeoxyglucose PET-CT scanning has become a useful adjunct in surveillance for thyroid cancer, detecting disease that can no longer concentrate radioiodine.²⁻⁴ A recent study by Shamma *et al.* examined the utility of ¹⁸F-fluorodeoxyglucose PET-CT scanning for detecting and localising recurrent or metastatic differentiated thyroid cancer in a cohort of 61 patients (59 of whom had negative radioiodine scans); they found an overall sensitivity and specificity in predicting histological disease of 68.4 and 82.4 per cent, respectively.⁵

While ¹⁸F-fluorodeoxyglucose PET-CT scanning can be extremely useful for imaging head and neck cancer, the radiographic findings for some disease processes can be confusing even with fused imaging techniques. There are several sources of false positive results. Infectious, autoimmune or granulomatous disease may show increased uptake owing to the high glucose turnover seen in activated granulocytes, lymphocytes and macrophages.¹ In a recent review, Rosenbaum summarised the many reports of false positive findings of ¹⁸F-fluorodeoxyglucose PET, which included cases of laryngeal uptake associated with vocalisation during the uptake period (generally this uptake is symmetrical), autoimmune thyroiditis, supraclavicular brown fat, physiological and post-chemotherapy hyperplasia uptake, post-operative inflammation, and some granulomatous disorders such as sarcoidosis, tuberculosis and fungal infections.^{1,5} Reports have also described PET-positive osteoradionecrosis in patients with a past history of nasopharyngeal carcinoma.⁶

One of the recognised non-neoplastic causes of ¹⁸F-fluorodeoxyglucose uptake is a granulomatous reaction to Teflon (i.e. teflonoma). Teflon (polytetrafluoroethylene) was used in the past to facilitate medialisation of the

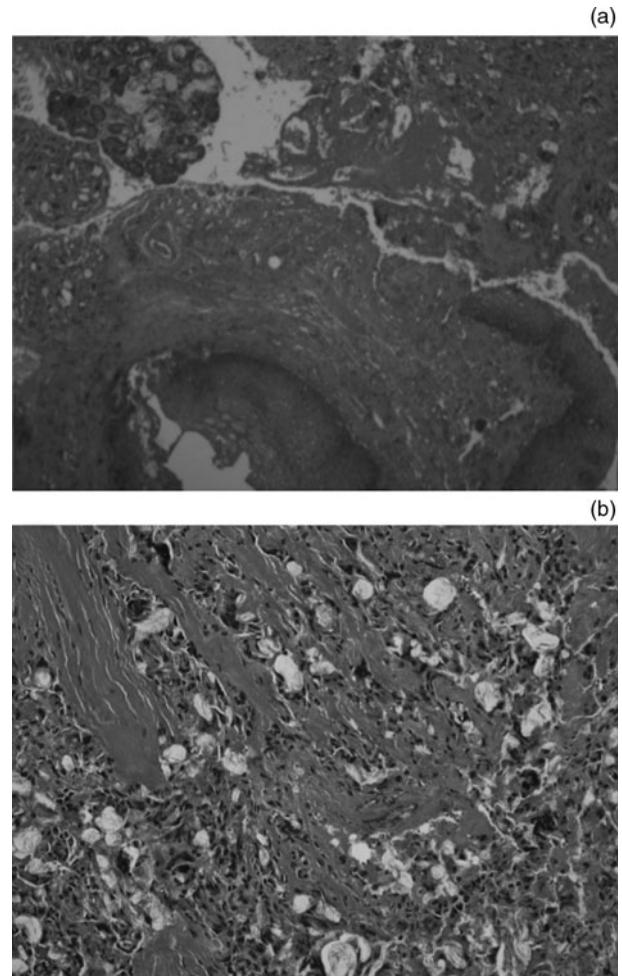


FIG. 3
(a) Photomicrograph showing squamous epithelium overlying the translucent Teflon material and a foreign body giant cell reaction (H&E; $\times 10$). (b) Photomicrograph showing translucent Teflon foreign body and numerous multinucleated giant cells (H&E; $\times 10$).

paralysed vocal fold. Teflon granulomas of the larynx are a known complication of vocal fold medialisation, occurring in approximately 2–3 per cent of patients.⁷ The development of Teflon granulomas, even long after a technically successful injection, was one of the problems that led to the virtual abandonment of this procedure for vocal fold medialisation in the late 1980s. Teflon granulomas have previously been reported in a number of the head and neck sites. Beginning as early as 1980, Teflon granulomas have been described as mimicking thyroid nodules and neoplasms,^{8,9} posterior fossa masses (following microvascular decompression with Teflon),¹⁰ and laryngeal and neck lesions.^{11,12}

Microscopically, Teflon appears as a translucent, amorphous aggregate. As described in many major surgical pathology textbooks, when macrophages encounter a foreign object too large to be phagocytosed (such as Teflon), they fuse to form larger foreign body giant cells composed of up to several dozen individual macrophages. This fusion is a hallmark of the foreign body giant cell reaction. Macrophages and foreign body giant cells tend to remain at the surface of an implant for the duration of its residence. Encapsulation can also occur, involving a generally avascular collagen shell being deposited around a foreign body, effectively isolating the foreign body from the host tissues.

Radiographically, Teflon granulomas are characterised by hyperattenuated, poorly defined masses on unenhanced CT scans, intermediate signal intensity on T2-weighted magnetic resonance images (less signal intensity than expected for a tumour) and avid 18F-fluorodeoxyglucose PET uptake. Eighteen F fluorodeoxyglucose avidity is not directly related to the Teflon, but is believed to be a by-product of the inflammatory reaction in response to the foreign body.

Unfortunately, these lesions can easily mimic neoplasms. Perhaps the best differentiator between benign disease and neoplasm in this situation is a careful patient history. One reason that Teflon was abandoned was its propensity to induce granulomas. Fortunately, newer injectable materials used for vocal fold medialisation are more biocompatible and less likely to cause long-standing inflammation.

Teflon granulomas have been reported in several head and neck sites. Positron emission tomography positive Teflon granulomas have previously been reported in the nasopharynx (secondary to Teflon injections for repair of velopharyngeal insufficiency),¹³ and two reports have described teflonomas located in or adjacent to the vocal folds.^{14,15} In one case report, the diagnosis was confirmed histologically after biopsy, and in the other a Teflon granuloma was presumed on the basis of the patient's history and the relative stability of the lesion over time, seen on PET-CT imaging.

- **Combined positron emission tomography (PET) and computed tomography (CT) scanning is being increasingly used in diagnosing recurrent or persistent thyroid cancer**
- **A variety of benign or inflammatory lesions may produce false positive results on combined PET and CT scanning**
- **Teflon, a substance once used in vocal fold medialisation, produces an 18F-fluorodeoxyglucose avid lesion on combined PET and CT scanning, which may be falsely interpreted as recurrent thyroid disease**

Our patient had a history of papillary thyroid cancer, an elevated thyroglobulin level and a negative radioiodine scan. Her 18F-fluorodeoxyglucose PET-CT scan showed an 18F-fluorodeoxyglucose avid laryngeal lesion suspicious for malignant disease. Subsequent biopsy was negative for malignancy, revealing a Teflon granuloma. While the lesion was suspicious for Teflon granuloma prior to surgical intervention, and there had been prior reports of 18F-fluorodeoxyglucose avid Teflon granulomas, we felt that a biopsy was warranted due to our patient's positive PET-CT scan and persistently elevated thyroglobulin level.

Conclusion

Eighteen F fluorodeoxyglucose PET-CT scanning is becoming an extremely important diagnostic tool in head and neck surgery and thyroid cancer. Radiologists and head and neck surgeons should be aware of the potential false positive laryngeal finding in those patients with a history of laryngeal Teflon injection.

References

- 1 Rosenbaum SJ, Lind T, Antoch G, Bockisch A. False-positive FDG PET uptake – the role of PET/CT. *Eur Radiol* 2006;**16**:1054–65
- 2 Schluter B, Bohuslavizki KH, Beyer W, Plotkin M, Buchert R, Clausen M. Impact of FDG PET on patients with differentiated thyroid cancer who present with elevated thyroglobulin and negative 131I scan. *J Nucl Med* 2001;**42**:71–6
- 3 Zimmer LA, McCook B, Meltzer C, Fukui M, Bascom D, Snyderman C *et al.* Combined positron emission tomography/computed tomography imaging of recurrent thyroid cancer. *Otolaryngol Head Neck Surg* 2003;**128**:178–84
- 4 Nahas Z, Goldenberg D, Fakhry C, Ewertz M, Zeiger M, Ladenson PW *et al.* The role of positron emission tomography/computed tomography in the management of recurrent papillary thyroid carcinoma. *Laryngoscope* 2005;**115**:237–43
- 5 Shammas A, Degirmenci B, Mountz JM, McCook BM, Branstetter B, Bencherif B *et al.* 18F-FDG PET/CT in patients with suspected recurrent or metastatic well-differentiated thyroid cancer. *J Nucl Med* 2007;**48**:221–6
- 6 Liu SH, Chang JT, Ng SH, Chan SC, Yen TC. False positive fluorine-18 fluorodeoxy-D-glucose positron emission tomography finding caused by osteoradionecrosis in a nasopharyngeal carcinoma patient. *Br J Radiol* 2004;**77**:257–60
- 7 Loehrl TA, Smith TL. Inflammatory and granulomatous lesions of the larynx and pharynx. *Am J Med* 2001;**111**(suppl 8A):113S–17
- 8 Sanfilippo F, Shelburne J, Ingram P. Analysis of a polytef granuloma mimicking a cold thyroid nodule 17 months after laryngeal injection. *Ultrastruct Pathol* 1980;**1**:471–5
- 9 Wassef M, Achouche J, Guichard JP, Tran Ba Huy P. A delayed teflonoma of the neck simulating a thyroid neoplasm. *ORL J Otorhinolaryngol Relat Spec* 1994;**56**:352–6
- 10 Megerian CA, Busaba NY, McKenna MJ, Ojemann RG. Teflon granuloma presenting as an enlarging, gadolinium enhancing, posterior fossa mass with progressive hearing loss following microvascular decompression. *Am J Otol* 1995;**16**:783–6
- 11 Wenig BM, Heffner DK, Oertel YC, Johnson FB. Teflonomas of the larynx and neck. *Hum Pathol* 1990;**21**:617–23
- 12 Moukarbel RV, Youssef M, Shab N, Hamdan AL. Pathology quiz case 1. Teflon granuloma. *Arch Otolaryngol Head Neck Surg* 2004;**130**:1438, 1440
- 13 Harrigal C, Branstetter BF 4th, Snyderman CH, Maroon J. Teflon granuloma in the nasopharynx: a potentially false-positive PET/CT finding. *AJNR Am J Neuroradiol* 2005;**26**:417–20
- 14 Hewitt RJ, Singh A, Wareing MJ. Teflon-induced granuloma: a source of false positive positron emission tomography and computerized tomography interpretation. *J Laryngol Otol* 2004;**118**:822–4
- 15 Yeretsian RA, Blodgett TM, Branstetter BF 4th, Roberts MM, Meltzer CC. Teflon-induced granuloma: a false-positive finding with PET resolved with combined PET and CT. *AJNR Am J Neuroradiol* 2003;**24**:1164–6

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Dr D Goldenberg takes responsibility for the integrity of the content of the paper.
Competing interests: None declared
