Resection of a Solitary Pulmonary Metastasis from Prostatic Adenocarcinoma Misdiagnosed as a Bronchocele

Usefulness of 18F-Choline and 18F-FDG PET/CT

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An asymptomatic 67-year-old man with rising prostate specific antigen (PSA) was referred to our center to perform an 18F-Choline positron emission computed tomography (PET/CT) scan. He had a prostatic adenocarcinoma [Gleason score 8 (4 + 4), stage T1cN0M0] treated 9 years ago by curative radiation therapy (RT; 74 Gy) and hormonal therapy for 6 months. Initial PSA was 10.7 ng/mL. The PSA follow-up was between 2.44 and 1.55 ng/mL. After 7 years, PSA raised at 4 ng/mL and a CT of thorax, abdomen, and pelvis was performed. It showed a bronchus-centered lung mass of 46 mm in the middle right lob, sharply delineated, round shaped and with the finger-in-glove sign, radiologically diagnosed as a bronchocele (Fig. 1). Abdomen and pelvis CT explorations were negative, especially on prostatic, pelvic lymph nodes, and skeletal areas. Few months after, PSA decreased at 2.7 ng/mL. Considering the mucocele as benign, conservative follow-up with thoracic CT imaging was decided instead of biopsy. One year after, the bronchocele was perfectly stable in size and shape on follow-up thoracic CT, but PSA raised again at 3.5 ng/mL and prostatic magnetic resonance imaging was then performed. A late and slowly rising PSA level may be a sign of only prostatic local failure after curative RT. Magnetic resonance imaging remained atypical without recurrence criteria and systematic prostatic biopsies were planned accordingly. According to French guidelines, 18F-Choline PET/CT scan was then performed to localize the occult biochemical recurrence. It remained negative in frequently involved areas in recurrent prostate cancer such as prostatic bed, pelvic lymph nodes, or skeleton. Patient could be considered with biochemical relapse only, but unexpectedly, there was an intense homogeneous 18F-Choline uptake into the known bronchocele which was perfectly stable in size with millimeter accuracy (Fig. 2). In our hypothesis, at this point, this phospholipidic hypermetabolism into the mucocele might be compatible with a mucus infection, a slowly evolutive malignant lung tumor such as a mucinous cystadenocarcinoma, a neuroendocrine carcinoma, a metastasis, or even a lung surfactant accumulation into the bronchocele, as 18F-Choline could be metabolized as phosphatidylcholine in mucus production. 18F-fluorodeoxyglucose (FDG) PET/CT scan was then performed to characterize the pulmonary lesion whether glucose metabolism in that abnormality favored a benign or malignant process. It showed a homogeneous FDG uptake into the bronchocele and no other abnormal uptake in particular in the prostatic, pelvic lymph node, or skeletal areas. This glucidic hypermetabolism was compatible with a mucous infection or a proliferating tumor. Prostatic biopsies were performed but no local recurrence was found. Performed in view of the abnormal FDG uptake, CT guided biopsy of the pulmonary mass, showed surprisingly adenocarcinoma cells with positive anti-prostatic acid phosphatase antibody immunohistochemical staining, and lead to the final diagnosis of a solitary lung metastasis of prostatic adenocarcinoma. On multidisciplinary medical staff decision and with patient agreement, surgical excision of the metastasis was performed. Right middle lobe lobectomy piece is shown on Figure 4. Macroscopically, the tumor was whitish, lobular, and sharply delineated. Microscopically, the tumoral glands were fused, lined by a single layer of malignant cells with polyadenoid architecture (Fig. 4). Immunohistochemical staining by prostatic acid phosphatase and PSA antibody was positive on all tumoral cells.

DISCUSSION

Any continuously rising PSA levels following a nadir after RT indicate local recurrence, systemic metastatic spread, or both. Although androgen deprivation therapy (ADT) is a popular option for management of recurrent prostate carcinoma displaying progression, some men will progress and may benefit from salvage local treatment such as radical prostatectomy, cryotherapy, interstitial RT, or high-intensity focused ultrasound. In the absence of documented metastases, men are often offered a salvage local treatment.

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ADT alone after a recurrence of prostate carcinoma is primarily reserved for patients with systemic disease. Currently, no consensus exists on the ideal timing or PSA cut-point for institution of therapy. Some clinicians advocate for early ADT, before the development of clinical metastases, whereas others prefer to wait until the development of clinical metastasis. It is not clear whether additional treatments...
given on the basis of rising PSA alone in asymptomatic men with prostate cancer increase overall survival. A substantial proportion of patients with elevated or rising PSA levels after initial therapy with curative intent may remain clinically free of symptoms for extended periods. The literature search did not identify any randomized trials of the treatment of PSA-only recurrence. According to guidelines, hormonal therapy is not routinely recommended for men with prostate cancer who have a biochemical relapse unless they have symptomatic local disease progression, any proven metastases, or a PSA doubling time of less than 3 months.

On the other hand, it might be possible that resection of identified metastatic lesions could contribute to the management of a subset of prostate cancer cases, as seen in other malignancies. There are two potential patterns of metastatic dissemination: a single-step process in which all metastatic cancer cells originate from the primary tumor, and a cascade process in which metastases metastasize. In the cascade process theory, early removal of metastases could potentially improve patient outcome. Some biochemical remission has been reported after resection of lymph nodes metastasis, and extensive dissection of the pelvic lymph nodes at radical prostatectomy has also been reported to increase biochemical cure rates in short-term follow-up.

Solitary lung metastasis of prostate cancer without osseous or lymphatic involvement is very rare, only 18 cases have been published. This unusual finding presents a therapeutic question of the role of metastasectomy, which contributed to a complete response in four cases on seven documented in literature. Those few cases of successful metastasectomy are exceptions to “normal” tumor biology and, as such, not generalizable, but it shows that in a very specific subset of patients with a low burden of metastases, even if it is usually regarded as a manifestation of systemic disease, minimally invasive surgery lobectomy or metastasectomy, may be an option and should be discussed in treatment strategy.

Mucoid impaction is a relatively common finding at CT that often manifests as tubular opacities known as the finger-in-glove sign. This sign most often appears in segmental bronchial atresia or cystic fibrosis. It may also be observed in inflammatory and infectious diseases (allergic broncho-pulmonary aspergillosis, broncholithiasis, and foreign body aspiration), benign neoplastic processes (bronchial hamartoma, lipoma, and papillomatosis), and malignancies (bronchogenic carcinoma, carcinoid tumor, and metastases).

In this unusual case, thoracic imaging specialist has been mistaken by the atypical and serendipitous presentation of the lung mass, with no radiological characteristic of bronchogenic carcinoma such as spiculated margins, cavitation, vascular convergence, or pleural retraction. Diagnosis error was even supported by stable follow-up CT in this slowly evolving tumor.

But the size of the lesion should have alert clinicians: according to guidelines, a lesion of more than 3 cm is not a nodule but a lung mass, and must be biopsied first, presuming to represent bronchogenic carcinoma until proved otherwise. FDG PET/CT is recommended to characterize indeterminate, solitary, solid, non-calcified lung nodule of more than 8 mm.

F-Choline is a PET tracer with promising results in the detection and evaluation of cancers with low glucose metabolism such as prostate carcinoma, hepatocellular carcinoma, or bronchioalveolar carcinoma. F-Choline is a precursor of the biosynthesis of phosphatidylcholine, essential component of cell membrane phospholipid, and depending on the choline kinase activity. Choline kinase activity is upregulated in proliferating tumoral cells. As a consequence, early trapping of F-Choline into tumoral cell membrane phospholipids reflects tumoral proliferation. F-Choline PET/CT is now often used in France to localize biochemical occult recurrence of prostate cancer in selected patients.

In this case, nuclear functional imaging helped to localize the biochemical prostate cancer recurrence by ruling out a local prostatic, regional nodal, or bone recurrence, and characterizing a radiologically known stable misdiagnosed lesion as a low but active and evolutive lesion, with an increased glucidic and phospholipidic metabolism. This unusual case underlines the usefulness of metabolic and functional imaging characterization by Fluorine-18 radiolabeled PET tracers by providing additional and complementary information to anatomical imaging.

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