Clinical application of fluorocholine positron emission tomography in relapsed prostate cancer

Aplicación clínica de la tomografía por emisión de positrones con fluorocolina en el cáncer de próstata recurrente

One third of prostate cancer patients will have relapse after initial treatment with radioablation or prostatectomy. Relapse is defined differently in various clinical scenarios. Following radical prostatectomy, a detectable PSA that increases in two consecutive measurements is consistent with recurrence. Following ablative radiotherapy, a PSA of 2 μg/L or more above the post-therapy nadir also represents recurrence.

Such elevations without physical or radiographical evidence of metastasis are defined as biochemical relapse (BCR). After prostatectomy, the median actuarial time from BCR to the appreciation of metastatic sites with conventional imaging techniques is eight years, and the time from that appreciation to demise is another five years. The PSA doubling time (PSADT) seems to be the most important factor determining survival in this population.

Some patients with BCR harbor occult distant metastases while others experience only local relapse with an indolent course. Distant recurrence often excludes patients from salvage radiotherapy and prompts the use of long-term palliative treatments. The standard imaging modalities in cases of BCR are computed tomography and skeletal scintigraphy, but their value in patients with a PSA < 4 μg/L is limited. Apart from the standard modalities, there is no consensus on the work-up that should be performed in cases of BCR.

Positron emission tomography coupled with computed tomography (PET/CT) is used for the metabolic evaluation of many cancers. Unfortunately, [18F]fluorodeoxyglucose (FDG)-based PET/CT—the most utilized form of PET—has limited value with slow-growing tumors such as prostate cancer. Additionally, confounding metabolic signals from post-prostatectomy fossae can decrease the loco-regional specificity of FDG-PET/CT, and the evaluation of pelvic structures is limited by tracer accumulation in the bladder.

Choline-based, rather than glucose-based, tracers may be more specific to prostate cancer. Prostate tumor cells are characterized by the ability to actively incorporate choline into the cell membrane as phosphatidylcholine in order to facilitate tumor-cell duplication. Choline uptake depends more on creatine kinase (CK) activity than on metabolic rate, and CK is upregulated in many prostate cancer cells.

Fluorocholine PET/CT may shed light on the evolution of prostate cancer bone metastases. In one study of the role of FCH-PET/CT in detecting osseous lesions in prostate cancer, three image patterns were identified: (i) FCH uptake without corresponding morphological changes on computed tomography; (ii) FCH uptake with concomitant bony changes on computed tomography; and (iii) negative FCH-PET but highly suspicious sclerotic changes on computed tomography. On follow-up of patients in this study, these three situations seemed to reflect a progressive pattern of abnormality. The first pattern corresponds to bone marrow involvement. This evolves to osteocytic changes representing the second pattern. Finally, densely sclerotic lesions with no metabolic activity reflect the third clinical scenario.

Salvage radiotherapy for patients with BCR is most likely to succeed when performed with PSA concentrations lower than 2.0 μg/L. Therefore, interest has been placed on experimental imaging techniques with relatively low but elevated PSA levels, where conventional modalities infrequently reveal metastases. Although the overall numbers are low, sensitivities of up to 71% have been reported with FCH-PET/CT in this range.

Cimitan et al. analyzed 100 patients with BCR and found 54 patients to have positive FCH-PET/CT; of the 46 patients with BCR but negative FCH-PET/CT, 41 had PSAs less than 4.0 μg/L. Despite the 98% reported precision, missing the source of BCR in patients with clinically-relevant PSAs lower than 4.0 μg/L was an important limitation of this imaging technique.

Isolated clinical cases illustrate how patients’ osseous and nodal metastases not yet detectable by conventional imaging techniques were identified using FCH-PET/CT (Figs. 1 and 2). These examples suggest FCH-PET/CT can be a useful clinical tool for some prostate cancer patients with BCR and can help to better define management.
Biochemical recurrence after radical prostatectomy and adjunct androgen blockade for pT3bN0M0 Gleason 9 (4+5) disease. Fluorocholine accumulated in the left ilium (C). This lesion was not observed on scintigraphy (A) or CT (B), but was confirmed by bone MRI (D).

Figure 2  Left iliac nodal metastases confirmed on CT with fluorocholine PET enhancement.

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References

9. Cimitan M, Bortolus R, Morassut S, Canzonieri V, Garbeglio A, Baresic T, et al. [18F]fluorocholine PET/CT imaging for the detection of recurrent prostate cancer at PSA relapse:
Intravesical protrusion of retropubic osteophyte mimicking a urinary bladder tumour

Protrusión intravesical de osteofito retropúbico que simula un tumor de la vejiga urinaria

Dear Editor:

The term osteoarthritis describes a common, age-related, heterogeneous group of disorders characterized by focal areas of loss of articular cartilage in synovial joints, associated with varying degrees of osteophyte formation, subchondral bone changes and synovitis. Joint damages are caused by a mixture of systemic factors (genetic inheritance, age, etc.) that predispose to the disease and local mechanism (cartilage lost, bone remodeling, osteophyte formation, etc.) that dictate its distribution and severity. Various genetic abnormalities have been described, but most sporadic osteoarthritis probably depends on minor contributions from several genetic loci. Osteoarthritic joint damages may be associated with clinical symptoms, but the severity of joint disease is only weakly related to that of the clinical problems.

We recently observed a 66-year-old man presenting to our department with a history of macrohaematuria, which occurred intermittently during the previous 2 months in absence of any other sign or symptom. The patient denied recent genitourinary traumas, surgery, infections, previous bladder cancer history or anticoagulant therapy. He underwent retropubic radical prostatectomy 9 years earlier and the actual PSA value was <0.01 ng/ml. Physical examination was negative. On urinary cytology, no malignant urothelial cells were identified and the urine culture revealed only erythrocytes and leucocytes, without evidence of infection. Pelvic ultrasonography showed a 3.2 cm × 2.0 cm large endoluminal mass located on the anterior bladder wall. Subsequent cystoscopy confirmed this bulge projecting into the vesical lumen, and CT scan of abdomen-pelvis showed a filling defect of the anterior bladder wall due to posterior symphysseal osteophyte secondly involving the urinary bladder (Fig. 1). No treatment was necessary, no further investigation was performed, and the patient was healthy with no signs or symptoms after a 10-month follow-up.

In fact, haematuria is the most common finding in bladder tumours. Usually, diagnostic tools include urine cytology, ultrasonography, and cystoscopy with description of the tumour (site, size, number and appearance) and further mucosal abnormalities. Intravenous urography (IVU) or CT of abdomen and pelvis is also performed in selected cases (tumours located in the trigone). However, a transurethral resection of the bladder tumours is essential to make a correct diagnosis and remove all visible lesions.

Differential diagnosis between primary bladder tumours and further diseases can be required: in the literature, benign or malignant entities, such as gastrointestinal carcinoma, focal inrolling of normal mucosa, secondly involving the bladder or mimicking a bladder neoplasm, are already described.

To our knowledge, this is the first report describing an osteophyte from the pubic symphysis presenting as a mass causing vesical impression and mimicking a bladder tumour. Therefore, osteophyte of the pubic symphysis has to be considered also when performing the abovementioned differential diagnosis. In fact, several pathologic processes can involve the symphysis, including infectious, congenital, metabolic, inflammatory, traumatic, and degenerative diseases. The most frequently occurring symptoms