Experience with 11C-Methylcholine

M. Picchio (Milan)

In recent years, positron emission tomography/computed tomography (PET/CT) with [11C]choline has been increasingly used for the evaluation of prostate cancer. Choline is a quaternary amine that is ubiquitously distributed in cells, mostly in the form of phospholipids. Prostate cancer is a slow-growing hormone-dependent disease with a natural progression from localized to hormone-refractory systemic disease. Biochemical failure of prostate cancer, i.e. persistently increasing prostate specific antigen (PSA) plasma levels after radical prostatectomy, occurs in about one-third of patients. Since different treatment approaches are available, including anti-androgenic hormonal therapy, salvage radiotherapy and chemotherapy, early diagnosis of recurrence is of pivotal importance for an effective treatment. PET/CT with [11C]choline proved to be useful for restaging patients with prostate cancer in biochemical failure. The major advantage of PET/CT over conventional imaging techniques is the capacity of assessing both local and distance disease in one single examination. However, the sensitivity of [11C]choline PET/CT in relation to different levels of PSA at biochemical failure is still not known. From a clinical perspective, it would be desirable to know the probability to obtain a positive [11C]choline PET/CT scan for low PSA values, when salvage radiotherapy has more efficacy and conventional imaging is frequently negative. This information could be extremely valuable for the referring physician in selecting patients for restaging examinations. Our studies suggest that PSA levels at the time of PET/CT is a positive predictive factor of [11C]choline PET/CT in prostate cancer patients with biochemical failure. This technique can be used for restaging prostate cancer patients even with PSA levels < 1 ng/mL.

While there is good agreement among several centres on the utility of PET/CT with [11C]choline for the detection of recurrence of disease after radical prostatectomy in patients with biochemical failure, controversies exist about the accuracy of this technique for the primary detection of prostate cancer. On the basis of our experiences, the following considerations about the clinical use of [11C]choline PET/CT at initial diagnosis studies can be drawn: the absence of correlation with Gleason score and disease stage confirms that [11C]choline PET/CT should not be used as a first-line technique for the initial diagnosis of prostate cancer. The accuracy of the technique for lymph node staging has to be further investigated. [11C]Choline PET/CT does not seem to provide substantial advantages in patients with the clinical suspicion of prostate cancer based on moderate increase of PSA levels, but negative biopsies. In addition, increased [11C]Choline uptake, which correlates with serum PSA levels, cannot reliably differentiate between benign and malignant prostate disease.

An interesting issue that has not yet been explored is the effect of anti-androgenic hormonal therapy on [11C]choline prostate uptake. Different formulations of hormonal therapy are increasingly used for the clinical management of prostate cancer. There are currently no guidelines addressing the question as to whether hormonal therapy should be withdrawn in staging or restaging PET/CT studies. If a significant inhibitory effect of hormonal therapy on [11C]Choline uptake is exerted, the capacity of the technique to detect the disease might be limited. Our data indicate that hormonal therapy, by decreasing prostate SUV$_{max}$, affects the accuracy of the histological analysis as well as the relation between SUV$_{max}$ and PSA. Moreover, it is possible that the inhibitory effect of [11C]choline uptake by the anti-androgenic therapy is exerted not only on the prostate gland, but also on lymph nodes or bones. Thus, hormonal therapy should be withdrawn before PET/CT at initial staging in order to minimize the likelihood of false negative findings.
References


