UMEÅ UNIVERSITET

Umeå University Medical Dissertation, New Series No 2072

^{11}C-Acetate-PET/CT in Primary Staging of High-Risk Prostate Cancer

Sara Strandberg

Akademisk avhandling

som med vederbörligt tillstånd av Rektor vid Umeå universitet för avläggande av medicine doktorsexamen framläggs till offentligt försvar i sal 260, byggnad 3A, Norrlands Universitetssjukhus fredagen den 27 mars 2020, kl. 09:00.
Avhandlingen kommer att försvaras på svenska.

Fakultetsopponent: Adjungerad professor Jens Sörensen, Institutionen för kirurgiska vetenskaper, Enheten för radiologi, Uppsala universitet, Uppsala, Sverige.

Department of Radiation Sciences

Organization
Umeå University
Department of Radiation Sciences

Document type
Doctoral thesis

Date of publication
6 March 2020

Author
Sara Strandberg

Title
^{11}C-Acetate-PET/CT in Primary Staging of High-Risk Prostate Cancer.

Abstract

Prostate cancer (PC) is the second most common cancer in men worldwide, affecting ~12%. Although most are clinically insignificant low-risk cancers, the more aggressive high-risk cancers require correct staging, prior to curative radiotherapy or surgery. Standard staging procedures and tools include clinical examination, estimated nomogram risk of pelvic lymph node (LN) metastases, and bone scintigraphy (BS). Additional staging information can be obtained with magnetic resonance imaging (MRI), computed tomography (CT) and positron-emission tomography/computed tomography (PET/CT). PET/CT can provide information on both functional and morphological changes.
The aims of the present thesis were to investigate the diagnostic and prognostic value of ^{11}C-acetate (ACE)-PET/CT in high-risk PC, and to optimize the ACE-PET protocol. In study I and II, higher detection rates of LN metastases and bone metastases were found with ACE-PET/CT, than with standard methods nomogram risk and BS. The higher ACE uptake in the prostate (prostate lipogenic tumor burden), the higher the risk of suspected LN metastases (N+ disease) on PET/CT. ACE-PET/CT findings correlated better than BS with follow-up data, and influenced therapy in 11-43%. In study III, PET reconstruction algorithm with resolution recovery showed more accurate functional tumor volumes compared to CT, and higher measurements of lipogenic activity, than reconstruction algorithm without resolution recovery. Study IV was part of an interventional radiotherapy study (PARAPLY) on high-risk PC, with addition of image-guided simultaneous integrated boost to delineated prostate tumors and pelvic LN metastases reported in ACE-PET/CT and MRI. Comparative analyses of clinical risk parameters and baseline ACE-PET/CT parameters showed significant associations between nomogram risk and prostate lipogenic tumor burden, between N+ disease on PET/CT and prostate lipogenic tumor burden, but surprisingly not between nomogram risk and N+ disease on PET/CT. PET with resolution recovery was superior in detection of N+ disease.
In conclusion, ACE-PET/CT showed a higher detection rate of suspected metastases compared to standard methods clinical nomogram and BS, in high-risk PC. PET reconstruction with resolution recovery seems to improve the diagnostic added value of ACE-PET/CT. Prostate lipogenic tumor burden could serve as a predictor of N+ disease. The prognostic value of ACE-PET/CT remains to be investigated in future studies.

Keywords
Positron Emission Tomography Computed Tomography, Radioactive Tracers, Carbon Radioisotopes, Prostatic Neoplasms, Lymphatic Metastasis, Neoplasm Metastasis, Neoplasm Staging.

Language
English

ISBN (printed)
978-91-7855-206-1

ISBN (digital)
978-91-7855-207-8

ISSN
0346-6612

Number of pages
75 + 4 papers