Lymph Node Scintigraphy Including SPECT/CT for Breast Cancer and other Malignancies

N.M. Bruin (Amsterdam)

Introduction

In the last few decennia the evaluation of drainage patterns has become an important field of interest in the nuclear medicine, mainly due to the increasing use of sentinel node biopsy (SNB). Lymphatic nuclear mapping, which entails a (peri-)tumoural injection of a radiopharmaceutical and subsequent planar lymphoscintigraphy or three-dimensional single photon emission computed tomography/computed tomography (SPECT/CT), may improve sentinel node (SN) localization in various types of malignancies such as breast cancer, melanoma and penile cancer.

Preoperative imaging

99mTechnetium(99mTc)-albumin nanocolloid and 99mTc-rhenium sulphide colloids are the main radiopharmaceuticals used in Europe for SN detection and localization. Lymphoscintigraphy can be performed in the afternoon of the day preceding surgery or on the day of surgery, depending on the logistics of the institution.

Planar lymphoscintigraphy, which is still the most widely used modality in Europe, usually only identifies the SN in the basins directly draining from the tumour site. In many cases SPECT/CT has an additional value over planar imaging as it depicts the SN location in relation to anatomical landmarks for the intraoperative procedure. Additionally, due to the correction for tissue attenuation, SPECT/CT is also able to detect SNs in patients without evident drainage on planar images, for instance in obese patients or in the case of deep lymphatic drainage such as in the pelvis, abdomen or mediastinum. In general, SPECT/CT is able to anatomically localize SNs in unusual sites of drainage. These imaging characteristics of SPECT/CT ensures that it is now being used for SN procedures in malignancies with a more complex lymphatic drainage such as prostate cancer, cervix cancer, and head and neck malignancies.

Acquisition parameters

The use of low energy high-resolution collimator(s) is preferred in order to avoid imaging artefacts as septum penetration, which can lead to the masking of SNs near the injection site. Additional dynamic acquisitions may be considered when rapid lymphatic drainage is anticipated (melanoma, head and neck, penile, testicular and vulvar cancer). Fifteen minutes and 2 hours after 99mTc-Nanocoll administration, anterior, lateral and oblique planar images are obtained. SPECT/CT is performed using a hybrid camera (SPECT: matrix 128x128 or 256x256, 40x30-sec frames, CT: 130 kV, 40 mAs, B60s kernel). SPECT is corrected for attenuation and scattering. After correction fused SPECT/CT images are displayed using Multiplanar Reconstruction (MPR) in the sagittal, transversal and coronal planes in order to enable comparison with the CT component of SPECT/CT. Maximum Intensity Projection (MIP) and volume rendering are useful methods of displaying SPECT/CT to improve anatomical recognition by the surgeon.

Conclusion

SPECT/CT is useful as an additional modality in patients scheduled for SNB and its findings must be interpreted in combination with those of planar lymphoscintigraphy. SPECT/CT can detect SNs in patients without visualization on lymphoscintigraphy. SPECT/CT enables accurate SN localization in the axilla, intramammary, parasternal, between the pectoral muscles, in the vicinity of the clavicle en scapula, groin, pelvis, head and neck, and other areas. The provided anatomical information can guide the surgeon to localize SNs more easily even using laparoscopic techniques. However, SPECT/CT cannot replace planar scintigraphy.

References:

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