

Research Project

MOONSTAR-Mobile Optical Navigated SPECT Camera with Augmented Reality

Third-party funded project

Project title MOONSTAR-Mobile Optical Navigated SPECT Camera with Augmented Reality

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The diagnosis of cancer is of major impact for each new patient faced with this dreaded diagnosis. At the beginning of every individual treatment planning the correct staging of the disease is of utmost importance. It is inalienable to know if the tumor has spread to the lymphatics. To exclude any regional metastases different tumors warrant different staging procedures. Evident regional disease is most often treated surgically in the context of tumor ablation for many different tumor sites (e.g. breast cancer, melanoma). In head and neck squamous cell carcinoma (HNSCC) the removal of the lymphatics is called neck dissection. The neck contains dozens of lymphatic vessels and draining nodes in a complex anatomic area. The procedure harbors a variety of potential risks such as nerve injury resulting in shoulder dysfunction, dysphagia, or facial asymmetry. Before the removal of the regional lymphatics clinical examination and imaging will be performed to assess any potential extent of spread. If there is no clinical and radiologic evidence of regional involvement the term "clinically negative neck" (cN0-neck) is used. Since clinical and radiologic staging show a limited accuracy, the treating physician has to make a decision upon further treatment in the case of a cN0-neck. Possible staging and treatment options are: a selective neck dissection, watch and wait, primary irradiation, or sentinel node biopsy (SNB). For melanoma and breast surgery SNB is considered to be the standard staging procedure. For selected head and neck tumors, SNB seems to be the most accurate histologic staging procedure with an ultimate high success rate. Histological work-up of neck dissections performed for the cN0 neck has shown 20-30% of occult metastases. In other words, in 70-80% of the cases the patient has been overtreated. The goals of SNB are to improve staging, reduce morbidity and

costs, and be as equally effective as selective neck dissection. The hypothesis behind SNB is as follows: the sentinel lymph node (SLN) is the first draining lymph node for a tumor of a specific site. All other lymph nodes are only reached subsequently. If metastases occur, they first occur in the SLN. The aim of the procedure is to localize and selectively excise the SLN. If the SLN is tumor free, no neck dissection is warranted, whereas if the SLN shows metastatic tumor deposits, a neck dissection will be added and the lymphatic drainage basin at risk will be removed. As a principle, a radioactive tracer (^{99m}technetium; ^{99m}Tc) is injected around the primary tumor. This ^{99m}Tc labeled colloid mimics the lymphatic drainage of tumor cells. Before surgery, the lymphatic drainage is observed using two different imaging techniques: lymphoscintigraphy (with the possibility of dynamic observation) and more recently single photon emission tomography (SPECT) with a fused computed tomography (CT) for better spatial resolution and anatomic information. Intraoperatively a hand-held gammaprobe serves for radio-guided localization and excision of the SLN. This research project focuses on the development of new hand-held

device (SPECT camera) with specific focus on faster and better identification of the first echelon node (SLN) in combination with an optical navigation system.

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