Positron emission tomography/computed tomography (PET-CT) is a modern test. Indications to perform it are expanding. The test allows for imaging of metabolic activity of human tissues [1]. Special diagnostic value of PET-CT derives from the theoretical possibility of imaging many physiological processes in the human body. The test uses chemical compounds which are absorbed and metabolized by human tissue [1]. Positron emission tomography/computed tomography is used in cancer diagnosis, neurology and cardiology [2]. Cancer diagnosis primarily makes use of the phenomenon of increased glucose metabolism in neoplastic cells, known since the 1930s (Warburg et al.) [3].

The test involves intravenous administration of glucose marked by the radioactive isotope of fluorine $^{18}$F (18-FDG, fluorodeoxyglucose). After the time necessary for the preparation's redistribution to tissues, positron emission tomography is performed to depict the locations of increased accumulation of the marker [4]. Revealed foci may suggest the presence of a tumour which is developing fast and is metastatic [1, 5]. Combining the test with classic images of digital computed tomography allows for precise anatomical localization of a suspected focus [6-8]. Test results are interpreted by a specialist in nuclear medicine and clinicians. Maximum standardized uptake value (SUV) of the radioactively marked metabolite is assessed and compared to physiological uptake. Positron emission tomography/computed tomography imaging is correlated with clinical data.

In worldwide literature this method’s sensitivity is assessed as 71-100% [7-9] and specificity 75-98% [8-10]. Positron emission tomography/computed tomography system resolution is approximately 3 mm. The low number of reports in Polish literature connected with the use of PET-CT in oral and maxillofacial oncology as well as access to the latest test convinced us to present our initial observations.

Materials and methods

From January 2008 to June 2010 the PET-CT test was performed in 60 patients with diagnosed cancer of the head and neck region. Patients’ age ranged from 28 to 86 (average 63 years). In total 71 PET-CT tests were performed (in some patients the test was repeated during oncological observation).

In 40 cases the test was performed to determine the stage prior to surgical treatment. In 8 patients PET-CT was performed to detect the probable primary origin of cancer. Twenty-three PET-CT tests were performed for sus-
pected loco-regional tumour recurrence after finishing the
treatment (the test was repeated during clinical observa-
tion in 11 patients).

In the course of preparation for the procedure all the
patients did not eat for about 4 hours. Before the test the
patients were given 1000 ml of drinking water. Next, intra-
venous injection of glucose marked with \(^{18}\)F isotope was
performed (FDG-PET-CT).

Marker dosage was determined individually, depending
on body mass. Radioactivity of glucose preparations at the
moment of intravenous administration ranged from 272 to
448 mBq (mean 338 mBq). PET-CT tests were performed
within 40-110 min (approximately 60 min) after \(^{18}\)F-FDG
administration. By the use of positron tomography foci of
increased accumulation of fluorodeoxyglucose were scanned
(fig. 1). Lymph nodes of SUV over 2 or focal asymmetric
uptake greater than background were interpreted as a sus-
pected growth process. Test result analysis considered cur-
tent clinical manifestations and accessory tests (ultra-
sonography, CT, histopathological tests). Test results are
presented in the form of both printouts which show the dis-
tribution of metabolic activity within the head and neck and
interpretations (fig. 2).

Results

Altogether, 71 PET-CT tests were performed. A focus of
increased metabolism was observed in 56 cases. In 15 tests
\(^{18}\)F-FDG uptake was within physiological norms in locations
of suspected cancer.

Metabolic activity of the location considered as the pri-
mary origin ranged from 3 to 17 SUV (mean 6.8 SUV). With-
in the neck region the uptake ranged from 1.7 to 13.3 SUV
(mean 4.2 SUV).

In 40 patients the test was performed to determine the
extent of the cancerous process. In 22 cases in this group
the PET-CT result confirmed the previous assessment of clin-
ical stage established based on imaging diagnostics (USG,
CT) and the scope of the planned procedure. In 8 cases the
test revealed foci of increased metabolism located outside
the region of planned tissue resection. Therefore, it was nec-
essary to extend the surgery to lower lymph nodes or ipsi-
lateral lymph nodes. In 6 cases the scope of the procedure
was limited due to the lack of metabolic activity in the neck
region and the lack of clinical signs of metastases to lymph
nodes. In 4 patients considerable loco-regional staging of
the neoplastic process was revealed (invasion of carotid ves-
sels, region of lung apex and prevertebral muscles). There-
fore, these patients were disqualified from surgical treat-
ment and referred for palliative treatment.

Analysis of postoperative histopathology test results
showed that in 4 cases metastases to lymph nodes of the
neck were not confirmed despite the fact that they showed
increased metabolism in PET-CT (false positive reports). In
these cases an inflammatory process was determined as
the reason for increased uptake. In 2 patients the test did
not reveal micro-metastatic foci in lymph nodes in the direct
neighbourhood of the primary origin (false negative report).

In 23 patients PET-CT was performed following the end
of the treatment within medical check-up (suspected can-
cer recurrence, fig. 3). In 14 patients in this group regions of
increased metabolic activity which indicated tumour pro-
gression were observed. In 4 patients the suspected regions
were observed within the chest, in 8 patients within lymph
nodes of the neck, and in 2 cases within the root of the
tongue. In 2 patients another operation was performed. The
other patients, following oncological consultation, were
referred for palliative treatment.

![Fig. 1. PET-CT machine](image1)

![Fig. 2. PET-CT examination. Increased metabolic activity in lower jaw tumour and upper cervical lymph nodes](image2)
In the group of 8 patients examined for the primary origin of the cancer, in 3 cases regions of increased metabolic activity within the palatine tonsils were observed (fig. 4). Tonsillectomy was performed on 2 patients. In 1 case presence of tonsil cancer was confirmed while in the other case local inflammation was observed. PET-CT in the third patient showed considerable loco-regional staging of cancer (numerous metastases not revealed previously). Following oncological consultation the patient was referred for chemoradiotherapy.

Discussion

The FDG-PET-CT test allows for assessment of potential staging of neoplastic disease. It also provides the possibility of more precise decisions regarding the scope of the procedure. It is especially significant in older patients with systemic symptoms. The short duration of the procedure, greater precision, decreased loss of blood as well as decreased anaesthesia and analgesics administration have a significant role in peri- and post-surgical prognosis.

Diagnostic possibilities of each test are limited. PET-CT does not allow for imaging of all the potential cancer foci. Micro-metastases smaller than 5 mm which show considerably small need for glucose (low radioactivity) are not revealed in the test [11-13]. This was also confirmed by our initial observations.

Due to its high sensitivity, PET-CT reveals potential foci both cancerous and inflammatory which show increased glucose metabolism. Therefore, test results require thorough interpretation by a team of experienced clinicians [12].

In conclusions:

1. The PET-CT test allows for pre-surgical assessment of cancer stage and might be useful in deciding on the scope of surgery.
2. In the case of unknown-origin metastases to lymph nodes it provides new opportunities to search for the primary cancer origin.
3. Positron emission tomography/computed tomography provides an opportunity to monitor neoplastic disease post-surgically.

References

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