Transiently Altered Distribution of F-18 FDG in a Patient with Subacute Thyroiditis

Myoung Hyoun Kim¹ · Dae-Weung Kim¹ · Soon-Ah Park¹ · Chang Guhn Kim¹

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Abstract F-18 fluorodeoxyglucose (FDG) is a highly influential radiotracer that provides valuable information in many cancer types. However, the normal biodistribution of F-18 FDG is often variable and can be altered by intrinsic or iatrogenic factors. We report a case of diffuse symmetrically increased skeletal muscle uptake and relatively decreased hepatic uptake on F-18 FDG PET/CT in a 57-year-old female with pulmonary adenocarcinoma. Detailed clinical evaluation and retrospective radiologic evaluation revealed that she had been diagnosed with subacute thyroiditis 2 weeks ago. After 6 weeks, F-18 FDG distribution was normalized at the follow-up PET/CT study.

Keywords F-18 FDG · Hyperthyroidism · PET/CT · Subacute thyroiditis

Fig. 1 A 57-year-old female with pulmonary adenocarcinoma was referred for F-18 FDG PET/CT as part of a staging workup. Maximal intensity projections (MIP) view (a) and coronal view (b) showed diffuse symmetrically increased skeletal muscle uptake and relatively decreased hepatic uptake. In addition, intense hypermetabolism was demonstrated in both thyroid lobes. The maximal standardized uptake values (SUVmax) of the thyroid gland, liver and psoas muscle were 8.9, 2.3 and 1.7, respectively. However, the primary malignancy, metastatic lymphadenopathies in the neck, supraclavicular, mediastinum and abdominal areas were identified without any difficulty. On the 6-week follow-up F-18 FDG PET/CT images (c, d), the primary malignancy and metastatic lymphadenopathies showed partial metabolic response after 2 cycles of chemotherapy with pemetrexed and cisplatin. Also, increased uptake of the skeletal muscle and decreased uptake of the liver were normalized. The SUVmax of the thyroid gland, liver and psoas muscle were 2.8, 3.4 and 1.0, respectively

✉ Chang Guhn Kim
leokim@wku.ac.kr; yam1004@naver.com

¹ Department of Nuclear Medicine, Wonkwang University School of Medicine and Institute of Wonkwang Medical Science, 895, Muwang-ro, Iksan 54538, Republic of Korea

Fig. 2 After review of the medical record and laboratory results, we found that she suffered from palpitations and hyperthyroidism. Her serum free thyroxine (free-T4) was 3.42 ng/dl (normal range: 0.70–1.48 ng/dl) and thyroid-stimulating hormone (TSH) was 0.006 μ IU/ml (normal range: 0.35–4.94 μ IU/ml), respectively. She underwent Tc-99 m pertechnetate thyroid scan 2 weeks before the F-18 FDG PET/CT study and both thyroid lobes were almost not visualized, suggesting subacute thyroiditis

Fig. 3 On serial F-18 FDG PET/CT images, the marked metabolic activity and diffuse enlargement of both thyroid lobes were decreased significantly (a, b). Her serum glucose level was within the acceptable limit (125 mg/dl), and there was no other possible cause of altered F-18 FDG distribution, such as hyperinsulinemia and excessive physical activity. The authors concluded that her transient hyperthyroid state caused abnormal F-18 FDG distribution. Two months after initial PET study, her thyroid function test revealed euthyroidism (free-T4: 0.80 ng/dl, TSH: 0.409 μ IU/ml). Subacute thyroiditis is thought to have a viral origin, with possible pathogens including mumps virus, hepatitis B and C viruses, cytomegalovirus, enterovirus and coxsackie viruses A and B [1]. Clinically, the condition is associated with severe pain that is usually localized to the anterior aspect of the neck and may radiate up to the jaw or ear. In addition, tenderness of the thyroid gland upon palpation and small diffuse goiter are frequently present. Common initial clinical features and laboratory investigation results include low-grade fever, fatigue, mild thyrotoxic manifestations, suppressed TSH, poor or no thyroid uptake and elevated ESR. Within a few weeks and after the depletion of the preformed thyroid hormone, about 30 % of patients will undergo a hypothyroid phase. The latter might last up to several months to be followed by a euthyroid phase. Changes in physiology that occur in hyperthyroidism affect every organ system in the body. It has been reported that incidental findings of symmetrically increased skeletal muscle and thymus F-18 FDG

uptake is a clue for the diagnosis of hyperthyroidism [2]. Chen et al. reported that PET scans showed a pattern of decreased liver and increased skeletal muscle F-18 FDG uptake in hyperthyroidism patients, this change in F-18 FDG distribution is in correspondence to the severity of hyperthyroidism status [3]. Hyperthyroidism leads to an enhanced demand for glucose, which is primarily provided by increased rates of hepatic glucose production resulting from increased hepatic gluconeogenesis [4]. The F-18 FDG uptake in the liver decreased in the hyperthyroid state because of an increase in endogenous liver glucose production. In addition, GLUT-2, a facilitative glucose transporter localized to the liver, is responsible for the efflux of glucose across the hepatocyte membrane and into circulation especially in the hyperthyroid state [5]. Regarding the skeletal muscle F-18 FDG activity in hyperthyroidism patients, it has been reported that thyroid hormones increase heat production by the muscles [6]. The increased skeletal muscle F-18 FDG uptake in hyperthyroidism patients may be the result of both increased GLUT-1 and GLUT-4 expressions and glucose consumption [7–9]. Lambert et al. reported a case of subacute thyroiditis limited to only thyroid gland findings of F-18 FDG PET and Tc-99 m pertechnetate thyroid scan [10]. To the best of our knowledge, this is the first documented case of altered whole-body F-18 FDG distribution detected on serial PET/CT studies in a patient with subacute thyroiditis. This case highlights the need to consider subacute thyroiditis as a cause of altered F-18 FDG distribution on PET/CT

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Compliance with Ethical Standards

Conflict of Interest Myoung Hyoun Kim, Dae-Weung Kim, Soon-Ah Park and Chang Guhn Kim declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent The institutional review board of our institute approved this retrospective study (WKUH 201603-HRE-023), and the requirement to obtain informed consent was waived.

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