IV. 11. Measurement of Salivary Radioactivity after Injection of Fluorodeoxyglucose

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Introduction

Positron emission tomography (PET) with a radiolabeled glucose analog, fluorodeoxyglucose (FDG) is an important tumor imaging modality, particularly for staging of cancers and in the differentiation of post-therapy changes from residual or recurrent tumors. It is therefore important to accurately define patterns of physiological uptake of FDG to avoid false-positive results that may lead to inappropriate patient management. Although FDG has been widely used as a PET tracer, the literature still suffers from a paucity of data relating to the normal tissue distribution of FDG. Knowledge of this normal distribution is vital to differentiation of pathological from physiological tracer uptake. It is necessary to differentiate the normal FDG distribution from the abnormal uptake as abnormal artifactual accumulation reported by Barrington et al.11 and Segall2) is often seen in the head and neck region.

We have previously reported the normal distribution of FDG after gum chewing. We found the intense glucose uptake in the tongue, masticatory muscles and salivary glands3) However, it is not fully known whether FDG is excreted into saliva or not. High accumulation in the tongue may be affected by FDG included in the saliva. The purpose of this study was to evaluate the radioactivity in the saliva after injection of FDG.

Materials and Methods

Thirteen healthy male subjects aged 21-32 (mean ± SD: 26.4 ±3.6y) with normal masticatory function and complete dentitions volunteered for the study. Written informed consent was obtained from each subject after a full explanation of the experiment. All subjects refrained from eating and drinking for at least four hours before the test. They were randomly divided into two groups. The first group (6 subjects) was requested to remain silent as control throughout the study starting from 5 min prior to the injection until the end of the study. The second group (7 subjects) was asked to keep on chewing one sheet of chewing gum (3g, apple mint, Ezaki Glico Co, Japan). All subjects performed each task for
30 min just after intravenous injection of approximately 40MBq of FDG. All tasks were performed with sitting posture in a dimly-lit room. The mixed saliva of each subject was sampled by spitting to disposable cup every 5 min (total seven times sampling) after injection of FDG. The Radioactivity of sampled saliva was measured for 60 sec using Well counter (Shimadzu Inc., Japan).

The salivary radioactivity was normalized for both the amount injected and the weight of sample according to the following.

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\text{Radioactivity (cps/g/mCi)} = \frac{\text{Decay corrected saliva concentration}}{\text{Weight / Injected dose}}
\]

The statistical significance of differences between chewing and resting was examined with a Mann-Whitney U test. A p value of less than 0.05 was considered significant.

**Results**

The salivary radioactivity in control and chewing group is summarized in Figure 1. The salivary radioactivity in the control group was immediately increased 5 min after the injection of FDG, and showed a plateau pattern 10 to 30 min after the injection. However, the degree of the salivary radioactivity varied among subject. The salivary radioactivity in chewing group was also immediately increased 5 min after the injection, and decreased 15 to 30 min after the injection. The salivary radioactivity level in control and chewing group amounted to 1/60-1/20 of arterial radioactivity. The salivary radioactivity in control group was generally higher than that in chewing group, and there was a statistically significant difference (p<0.05) at 15, 20, 25 and 30 min after injection, when combined data were compared.

**Discussion**

FDG metabolism regarding the salivary glands has not been fully investigated, although the enhanced uptake of FDG into brain, cardiac muscle and skeletal muscle is well recognized. The results of our study confirm that the saliva include the radioactivity after the injection of FDG. FDG may be excreted through the salivary glands. Saliva is made from blood plasma in the salivary glands, which generally include glucose 1/100 to 1/50 of blood sugar4,5). As the salivary radioactivity level in the control and chewing group amounted to 1/60-1/20 of arterial radioactivity in our experiment, FDG may be also excreted in the same way of blood sugar. In this study, we used previous data regarding arterial radioactivity that measured other experiment as we omitted blood sampling.

The amount of salivary radioactivity was 7-10 cps/g/mCi and 4-6 cps/g/mCi in the control and chewing group respectively, while tissue radioactivity of the tongue muscle was 100-150cps/g/mCi and 300-600cps/g/mCi on PET image in the control and chewing group.
respectively. Tissue count on PET images would not be affected the radioactivity excreted into saliva.

In our study, the salivary radioactivity in chewing were lower than that in control group, and there was a statistically significant difference (p<0.05). It is widely known that glucose concentration in saliva excreted by stimulation such as taste and chewing, decreases as glucose consumption increase in salivary glands.

In conclusion, we found that, the saliva include the radioactivity after the injection of FDG, however, tissue count on PET images would not be affected the radioactivity excreted to saliva. The level of salivary radioactivity would vary depending on the condition of saliva excretion.

References


Fig. 1 The radioactivity of saliva in resting and chewing group. The statistical significance of differences between chewing and resting was examined with a Mann-Whitney U test. *Statistically significant at p<0.05.