TO THE EDITOR: In a recent article, Dr. Allweis et al. presented a retrospective study of the frequency of sialadenitis following iodine-131 (131I) therapy (1). In ten of 87 patients there were subjective findings of sialadenitis. They pointed out, that objective measurements will be needed to define accurately the prevalence and natural history of salivary gland abnormalities following 131I therapy.

This has been studied by others (2) as well as by our group (3). We use computerized scintigraphy with technetium-99m pertechnetate as an objective method for the assessment of salivary gland function and calculate excretion ratios to get numerical figures for this assessment (4).

There is a significant correlation between persistent loss of salivary gland function and accumulated dose of 131I (Table 1). There will be a further decrease after additional doses (2) and after more than 1.0 Ci 131I xerostomia will be a common finding. Flow-increasing food like lemons will shorten transit times through salivary glands and therefore reduce radiation exposure to 1/5 to 1/10 (2). Therefore, continuous lemon sucking is part of our 131I treatment for thyroid carcinoma.

TABLE 1
Sequential Salivary Gland Scintigraphy 6 mo After Last Treatment* Excretion Ratios (ER) for Different Cumulative 131I Doses (in Ci)

<table>
<thead>
<tr>
<th>Dose (Ci)</th>
<th>Excretion Ratio (ER)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>53±11</td>
</tr>
<tr>
<td>2</td>
<td>44±12</td>
</tr>
<tr>
<td>8</td>
<td>29±5</td>
</tr>
<tr>
<td>5</td>
<td>23±4</td>
</tr>
</tbody>
</table>

All groups are significantly different from each other (adapted from [3]).

Nuclear Medicine Procedures in Nuclear Power Plant Employees

REPLY: We appreciate the letters of Dr. Creutzig and Drs. Speigel, Reiners, and Börner which called our attention to several studies concerning salivary gland function following iodine-131 therapy for thyroid carcinoma published in the German literature. We were unaware of those studies and are pleased that our results confirmed those found by the above workers, which indicate that the relatively high proportion of individuals who receive therapeutic doses of radioactive iodine develop salivary gland abnormalities. Those groups of investigators recommend that patients suck on lemon candies and/or chew gum in order to increase saliva flow and, therefore, reduce radiation exposure to the salivary glands. We also advise our patients to do this. We made this recommendation in the original manuscript submitted to The Journal of Nuclear Medicine but it was deleted after one of the reviewers pointed out that we were unable to provide objective proof that increasing salivary flow decreased radiation damage to the salivary glands.

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In the event of internal contamination, the quantity and isotopic makeup must be determined by whole-body counting or bioassays performed on site.

Any abnormal exposure or reading must be explained in detail to the Nuclear Regulatory Commission (NRC), whose reports are open to public scrutiny. The local newspapers faithfully report all actions of the NRC with respect to the plant. More seriously, the presence of radioactivity in patients, and their excreta, can interfere with detection of other nonroutine contamination by tripping the monitors.

The problems of therapeutic radionuclides can occur with diagnostic agents as well. In fact, a 5 mCi (185 MBq) dose of technetium-99m (99mTc) pertechnetate used for a thyroid scan in the first patient and a 10 μCi (370 KBq) 131I uptake dose used in the second patient activated the monitors. In another case, several hundred nanocuries of 131I were detected in an employee whose wife had been treated 10 days previously for thyroid carcinoma. This activity was discovered on a routine body count which is performed at 6-mo intervals on all occupationally exposed employees. The instrument employed in this case was a whole-body scintillation counter equipped with four 4 cm × 8 cm sodium iodide crystals, a multichannel analyzer, and a moving bed. Given the frequency of performance of diagnostic nuclear medicine procedures and the numbers of people employed by nuclear power plants (to say nothing of other nuclear industries), this is surely not a unique occurrence.

The employer does not want to be in the position of denying its employees access to necessary medical procedures, but obviously has a legitimate concern with keeping its monitoring systems operative. From the standpoint of the utility, fission-produced radionuclides such as 131I and xenon-133 can come from the reactor or from a patient, but the source cannot be distinguished. Thus, a potential problem with the reactor could be masked. While radionuclides such as 99mTc, thallium-201 (201Tl), gallium-67, iodine-123, and other neutron-poor gamma emitters are obviously not reactor generated, their gamma rays do expose TLDs of the patient and his co-workers, and the source cannot be traced. Indeed, the mercury x-rays of 201Tl are recorded as beta particles. In any case, medicinal radionuclides can be a source of unexplained radiation, placing the utility in jeopardy of severe punitive actions by the regulating bodies.

The solution we have chosen to accommodate all parties is as follows.

1. The hospital has supplied the plan radiation safety officer (RSO) with a list of all radiopharmaceuticals used, with dose ranges, gamma-ray energies, physical and effective half-lives, and methods of excretion.
2. Working through his personnel office and by in service education seminars, the RSO will require any employee receiving a diagnostic or therapeutic radionuclide to obtain a note from the nuclear physician stating the radiopharmaceutical, the dose, and the time of administration.
3. Plant personnel will reassign the employee to nonmonitored areas for a period of time determined by the RSO.
4. The RSO will perform appropriate monitoring and/or bioassays before allowing the employee to return to the controlled area.

This system is too new to evaluate adequately at this time. If time and experience result in changes or refinements, we will share them with the nuclear medicine and utility communities.

An analogous situation exists in other occupations where monitored employees handle radioactivity. Such areas include radioactive waste disposal and volume reduction facilities, radionuclide production and transport operations, academic and pharmaceutical research institutions, the many and varied industrial locations at which radioactive sources are employed, and of course monitored regions in hospitals. While monitoring requirements in such occupations may be less strict than in nuclear power plants, medically generated beta and gamma radiation can be a source of unexplained contamination and erroneous badge readings. Protocols, similar to that presented above, but tailored to the individual radiation safety program for each facility, may be appropriate.

References

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Effect of Protein Mass on the Pharmacokinetics of Murine Monoclonal Antibodies

TO THE EDITOR: Having read the arguments of Dr. Lawrence Williams and the reply by Dr. Ban An Khaw (J Nucl Med 25:1395–1396, 1984) concerning the effect of protein mass on the pharmacokinetics of murine monoclonal antibodies (MoAb), we have decided to muddy the water further by comments of our own.

Attempts in our laboratory to alter the pharmacodynamics and body distribution of 111In MoAbs in mice by increasing the MoAb mass were unsuccessful unless there was circulating antigen present in the system. As little as 1.0 mcg and as great as 500 μg of protein were administered.

Interestingly enough, antibody mass had a dramatic effect on the distribution of murine MoAbs in humans. In patients with melanoma, the administration of a 1 mg dose of 111InP96.5 MoAb resulted in 50% of the radiopharmaceutical being cleared from the vascular compartment by the end of a 2-hr infusion. The organs primarily responsible for this removal were the liver and bones (marrow). The radiopharmaceutical remaining in the vascular compartment after this initial time point disappeared from the circulation with a much longer half-time. As we increased the MoAb mass from 1 to 20 mg over the next several patients, we markedly prolonged the serum half-time and reduced the early uptakes of