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## Absorption of $Sr^{90}SO_4$ from the Lung.* (28262)

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In experiments with mice it was found that $Sr^{90}$ appeared in the skeleton soon after inhalation of $Sr^{90}SO_4$ aerosols(1). Since $SrSO_4$ is not very soluble in water, rapid transport of Sr across the alveolar membrane was not expected. Therefore, it was speculated that $Sr^{90}SO_4$ was largely solubilized in the acid environment of the gastrointestinal tract(2) which receives a large fraction of inhaled material cleared from the respiratory tract, and that this accounted for the rapid accumulation in the skeleton. To test this, it was necessary to evaluate the role of the lung in affecting the solubilization and translocation of $Sr^{90}SO_4$.

*Methods.* In a female dog, weighing about 25 kg, the trachea and lower respiratory tract were isolated from the gastrointestinal tract by surgically preparing a ventrocervical tracheal fistula. The laryngeal stump of the trachea was closed with sutures and the distal stump leading to the lung was sutured to the underlying muscle and tissues to assure a patent lumen regardless of the posture of the animal. After allowing one week for post operative healing the dog was allowed to inhale a $Sr^{90}SO_4$ aerosol through the fistula for one hour. A total of 8.3 $\mu$c Sr-$Y^{90}$ was deposited. Blood samples were withdrawn *via* an intravenous catheter introduced through the jugular vein to the base of the heart. All feces and urine were collected daily, and all tissue taken upon sacrifice of the animal 7 days post exposure. Gauze pads were held in place over the fistula to filter inhaled air and to collect mucus cleared from the respiratory tract. The gauze pads were changed frequently and were analyzed for Sr-$Y^{90}$. The dog received 24 hour professional care, water *ad libitum,* and a normal diet of commercial dog food. The dog was sacrificed by exsanguination at the common carotid artery while under pentothal sodium anesthesia.

*Results.* The levels of Sr-$Y^{90}$ in one ml of blood are plotted in Fig. 1 as per cent of the total Sr-$Y^{90}$ deposited. Immediately after exposure about 0.006% of the Sr-$Y^{90}$ deposited was present in 1 ml of blood, or 12% in all of the blood, assuming a total blood volume of 2 liters. From the 3rd to the 24th hour after exposure the radioactivity content of the blood decreased exponentially and was maintained from one day to one week after exposure at about 0.0004% per ml of blood. This probably suggests that an equilibrium between blood and tissue content of Sr-$Y^{90}$ was reached and maintained after the first day.

The daily clearance of Sr-$Y^{90}$ from the trachea and the excretion in urine and feces are also shown in Fig. 1. The Sr-$Y^{90}$ collected on the gauze pads was probably cleared from the lung by mucus-ciliary processes. Four per cent of the total Sr-$Y^{90}$ deposited was eliminated in this manner on each of the

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TABLE I. Total Distribution of Inhaled $Sr^{90}$ One Week After Exposure.

| | $\mu$c Sr-$Y^{90}$ | % of total deposited |
|---|---|---|
| Bone | 3.9 | 49 |
| Lung | .19 | 2.2 |
| Tissue (all others) | .12 | 1.4 |
| G. I. tract | .062 | .7 |
| Blood | .045 | .5 |
| Eye | .0070 | .08 |
| Trachea | .0040 | .04 |
| Urine | 1.8 | 17 |
| Feces | 1.1 | 14 |
| Gauze pads | 1.2 | 15 |
| Total | 8.3 | 100 |

first 2 days after exposure. Subsequently, about 1% was eliminated each day.

Except for the first day, urinary and fecal excretion of Sr-$Y^{90}$ were almost identical. During the first day after exposure 4% was excreted in urine and 0.2% in feces. Subsequently, the amounts excreted daily decreased from about 4% to a little less than 1%.

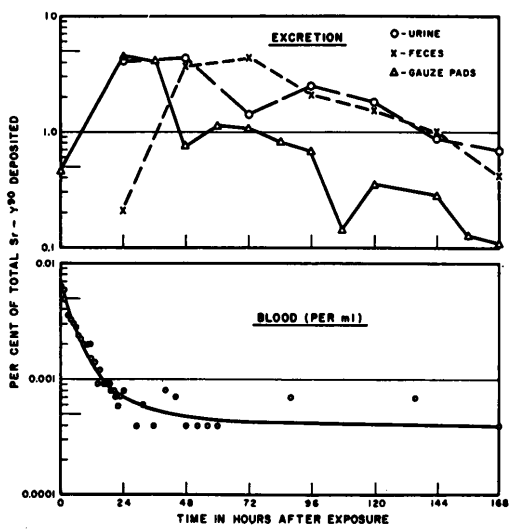


FIG. 1. Excretion and blood content of Sr-$Y^{90}$.

The distribution of Sr-$Y^{90}$ in the tissues of the dog one week after exposure is shown in Table I. About one-half the total Sr-$Y^{90}$ deposited was in bone. Even though $Sr^{90}$ was rapidly translocated from the respiratory tract to the blood and the skeleton, the lung still retained 2% of the total deposited, or about 4.5% of the body burden one week after exposure. All other tissues contained less than 1% of the body burden. A total of 46% of the total deposited was excreted by the 3 routes: urine, feces, and through the tracheal fistula.

Conclusions based on this experiment should be tempered by the fact that only one dog was used. The lung apparently provided no more than a temporary barrier for the entry of $Sr^{90}$ into the body even though it was inhaled in one of the least soluble forms, the sulfate.

*Summary.* The role of the lung in affecting the translocation of inhaled $Sr^{90}SO_4$ was evaluated by exposing a dog to a $Sr^{90}SO_4$ aerosol through a tracheal fistula. About one-half of the Sr-$Y^{90}$ deposited was rapidly translocated to the bone, and only 2% was retained in the lung one week after exposure. Fifteen per cent was cleared *via* the trachea, probably by the ciliary processes.

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