REPLY: Dr. Komiyama has commented that it is not necessary to understand the risk associated with childbirth during brain SPECT for moyamoya disease, because patients have never complained of neurological symptoms.

We examined the relationship between complications of childbirth and neurological symptoms by reviewing our patients with moyamoya disease who had undergone surgery over the past 20 y. A preliminary analysis revealed that only 1 of 11 patients had a difficult delivery. They may or may not have had neurological symptoms associated with moyamoya disease. A study from the perspective of neurological surgery will be completed next year.

Although we feel that Dr. Komiyama's opinion may be correct, it is necessary to prove that abnormalities in cerebral blood flow (CBF) are not induced during childbirth. This is particularly true for natural delivery, because obstetricians in Japan recommend cesarean delivery rather than natural delivery to avoid complications during childbirth.

Brain SPECT should be performed during rehearsals of natural delivery using a minimal dose of technetium to show that CBF does not change. The results of this procedure should help convince obstetricians to opt for natural childbirth in patients with moyamoya disease.

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Retreatment of Graves' Disease with Radioiodine [131]I

TO THE EDITOR: Leslie et al. (1) reported their experience with retreatment of Graves' disease with similar deposited doses of radioiodine [131]I. They found that 15.6% of their patients required a second dose, and there was no significant difference between the percentage of patients who remained hyperthyroid after either dose. In an important paper published in the Journal in 1971, not referenced by Leslie et al., Spencer (2) examined the outcomes in three large clinical series in which multiple doses (4–9) were administered, each dose yielding the same ^{131}I concentration per gram of thyroid. When the percentage uncured (i.e., still hyperthyroid) was plotted against number of doses on semilog paper, the data in each series fell in a straight line, indicating that the fraction of patients who remain hyperthyroid is constant for a given deposited dose.

In Figure 1, I have replotted the data of two of these series (3,4) and have added a third (5) from a more accessible publication. In each series, the same ^{131}I concentration was deposited at successive dosings, which in one series was carried out to 11 dose administrations. Spencer (2) concluded that the uncured fraction with any dose could be described by $H = H_0 e^{-\lambda D}$, where H is the number of patients not cured after any dose, H_0 is the original number of patients, λ is a constant describing the fractional cure rate per dose and D is the number of doses administered.

For Silver's series (4) (Fig. 1), 50% of patients (H/H₀) were still hyperthyroid after one dose, so that λ = 0.693, i.e., about 31% of patients were always uncured after every dose of this size (80 μCi/g). It is therefore not surprising that Leslie et al. (1) had the same failure rate after both dosings.

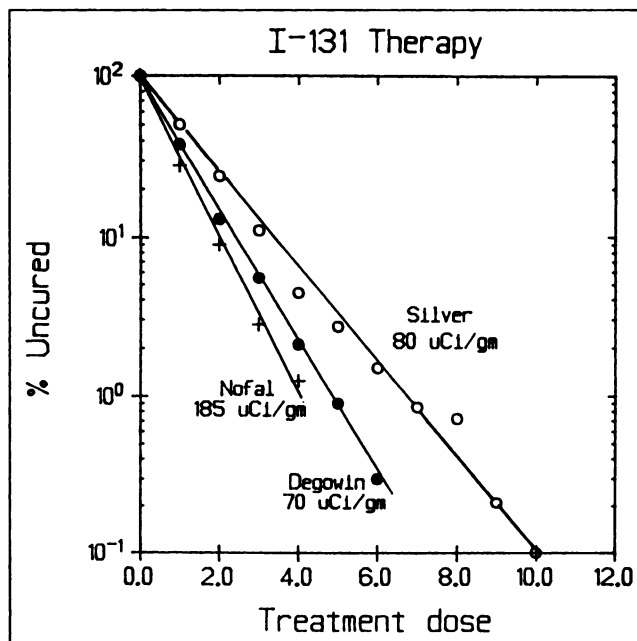
FIGURE 1. Response of hyperthyroid patients to repeated treatment with sodium iodide ^{131}I in same tissue concentrations. Vertical axis = percentage uncured (i.e., still hyperthyroid); horizontal axis = number of doses administered.

It appears that λ is greatest for the highest ^{131}I concentration (Fig. 1). To get a better feel for this relationship, I have plotted the mean success rate for each of 12 series in which a constant ^{131}I concentration was used (Fig. 2). The mean success rate is the same as the success rate for each dose. There is a strong linear relationship, $y = 0.0018x + 0.48$, with a correlation coefficient (r)
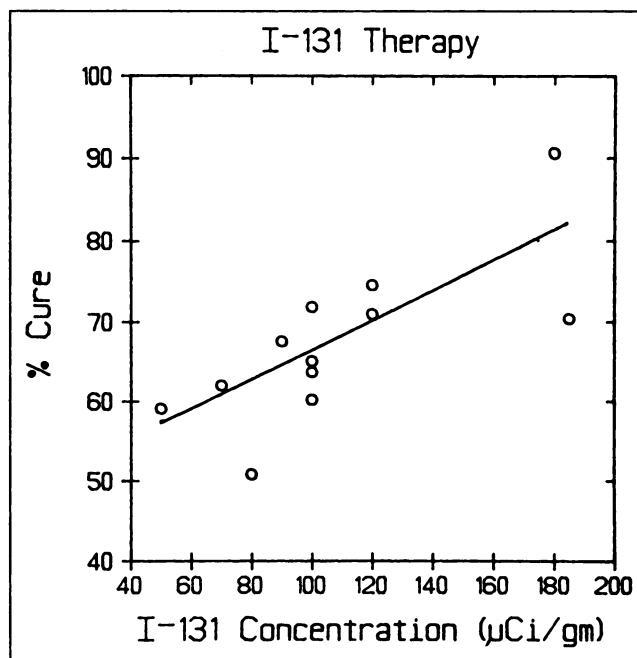

FIGURE 2. Percentage of patients cured of hyperthyroidism by treatment with sodium iodide ^{131}I at a given tissue concentration, in 12 published series. Vertical axis = percent of patients cured; horizontal axis = [131]I tissue concentration.

of 0.698, but the wide spread, confirmed by the r^2 value of 0.49, indicates that one or more other factors play(s) a significant role in tissue responsiveness to ^{131}I treatment. Interestingly, multivariate linear discriminant analysis of 21 relevant parameters by Turner et al. (6) identified only ^{131}I uptake, gland size and the presence or absence of eye signs as significant outcome variables; yet the proportion of patients correctly reclassified according to outcome using these significant variables was only about 50%. We still do not know why outcomes vary.

Harbert's suggestion (7) that additional ^{131}I delivered doses be increased over the initial dose, as reported by Leslie et al. (1), can be justified by the above analysis, if the physician wants a greater probability of cure.

REFERENCES

1. Leslie WD, Peterdy AE, Dupont JO. Radioiodine treatment outcomes in thyroid glands previously irradiated for Graves' hyperthyroidism. *J Nucl Med.* 1998;39:712–716.
2. Spencer RP. Response of the overactive thyroid to radioiodine therapy. *J Nucl Med.* 1971;12:610–615.
3. Nofal MM, Bierwaltes WH, Patno ME. Treatment of hyperthyroidism with sodium iodide I-131: a 16-year experience. *JAMA.* 1966;197:605–610.
4. Silver S. *Radioactive Nuclides in Medicine and Biology,* vol II. *Medicine,* 3rd ed. Philadelphia, PA: Lea & Febiger; 1968:171–182.
5. DeGowin EL, Hodges RE, Hamilton HE, Evans TC. Thyrotoxicosis treated with small repeated doses of radioiodine. *Arch Intern Med.* 1959;104:959–965.
6. Turner J, Sadler W, Brownlie B, Rogers T. Radioiodine therapy for Graves' disease: multivariate analysis of pretreatment parameters and early outcome. *Eur J Nucl Med.* 1985;11:191–193.
7. Harbert JC. Radioiodine therapy of hyperthyroidism. In: Harbert JC, Eckelman WC, eds. *Nuclear Medicine Diagnosis and Therapy.* New York, NY: Thieme Medical Publishers; 1996:951–973.

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