Estimating Glomerular Filtration Rate in Children

TO THE EDITOR: We read with interest the letter to the editor by Fleming and Waller (*1*). We regret that we were not presented the opportunity to reply earlier. We believe that the publication of a letter and a reply in two different issues does not best serve the interest of the readers.

We take note of Fleming and Waller's "paternity claim" of the concept of a universal method for both adults and children. After carefully reviewing their original article (*2*), we still believe that this concept was first described by Bubeck et al. (*3*) and Bubeck (*4*). Moreover, we maintain that the concept of a "single-sample adult method using prescaled plasma sample" has not been validated for glomerular agents. Because the article by Waller et al. (*2*) was published in the widely available *The Journal of Nuclear Medicine*, the nuclear medicine community can make its own judgment concerning this claim.

Our study (*5*) was undertaken to verify the concept that *any* validated single-sample adult method can be used in children provided the plasma sample was prescaled. We selected three well-known adult methods (*6–8*), including the one recommended by the Consensus Committee of Radionuclides in Nephrourology (*9*). The results indicated that the single-sample adult method using prescaled plasma concentration had a lower accuracy than the specific pediatric single-sample method.

In our article, we did not say that there was no method that can be used in both adults and children. Such a method does exist, but its performance is usually slightly inferior to specifically designed adult or pediatric methods. The data in the literature (*6–8*), including those of Waller et al. (*2*), show that for a glomerular agent, the optimal time for a single-sample technique in adults is approximately 240 min. A slight decrease in accuracy occurs when a 180-min sample is used. In children, the optimal time is between 90 and 120 min (*10*). The 180-min sample can also be used if a slightly lower accuracy is accepted (*1*). Fleming and Waller wrote that their 180-min single-sample method worked well in both adults and children. However, they have not demonstrated that the accuracy of their method was superior or equal to a specifically designed adult or pediatric method.

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Physical and Chemical Nature of Technegas

TO THE EDITOR: The article by Senden et al. (*1*) concerning the physical and chemical nature of technegas implies that the carbon coating of technetium metal particles is chiefly responsible for the extended retention time of this agent in the lungs. This conclusion was reached using the results from microscopic and thermogravimetric analysis.

We would like to draw readers' attention to two articles that preceded the article by Senden et al. in which microscopic techniques were also used in the analysis of technegas particles (*2,3*). Although the high-resolution transmission electron microscope (HRTEM) study of technegas and pertechnegas particles by Isawa et al. (*2*) has drawn some criticism (*4*), it still represents the first study of high-resolution imaging of carbon particulates collected by impaction/deposition in which the most notable result was the identification of two distinct types of metal-containing carbon particles differentiated by the size of the associated metal phase. The carbon particles containing smaller metal phases bear a striking resemblance to those detected by Jackson et al. (*3*) using scanning TEM (STEM). On the basis of the HRTEM images alone, Isawa et al. (*2*) proposed that the metal was encapsulated by the associated graphite.

X-ray photoelectron spectroscopic (XPS) results for the analysis of technegas particulates and the crucible residue containing technetium are presented by Jackson et al. (*3*), along with results from a STEM investigation. Radiographic fluorescence indicated that oxygen was associated with the metal in the particles analyzed. This result agreed with the XPS measurements, for which the chemical shift of ^{99m}Tc could only be rationalized by an oxygen association. The XPS result for the crucible residue confirmed that the high temperature of the graphite during the crucible burn is sufficient to reduce some of the technetium to either the pure metal or the metal carbide. In view of this result, Senden et al. (*1*) confirm previously published spectroscopic results.

Isawa et al. (*2*) and Jackson et al. (*3*) cast doubt on the assertions that one particular type of technegas particle, that is, pure metal wrapped in graphite, is solely responsible for the properties of this agent. A review of the literature concerning the mechanisms and types of metal crystallites encapsulated by carbon revealed an article by Seraphin et al. (*5*) in which metal oxide particles were encapsulated by graphite at much higher temperatures (3500°K) than those used to generate technegas. More recent articles by Dai et al. (*6*) and Guo et al. (*7*) suggest that midtransition-row metals, particularly those adjacent to technetium in the periodic table, may act as templates for the growth of both amorphous and ordered carbon phases. These studies establish a link between the size of the metal particle and the nature of the associated carbon particle in which smaller metal crystallites, approximately 5 nm, act as templates for the growth of carbon phases from one face of the particle, whereas metal crystallites 50 nm or larger were found to be exclusively encapsulated. The very presence of metal crystallites, on the order of a few nanometers, associated with carbon in all three electron microscope investigations (*1–3*) infers that conclusions based on analysis of the results for larger metal crystallites alone are invalid.

Senden et al. (*1*) assert that carbon encapsulation of the radionuclide is critical for passivation of the metal, yet direct evidence that refutes such a claim is found in the article by Pillai et al. (*8*), who used a ^{99m}Tc-labeled iron oxide colloid and achieved a lung clearance rate in canines similar to that of technegas. Hydrated TcO_2, that is $TcO_2.nH_2O$, is also colloidal and would be expected to behave in a fashion similar to the ^{99m}Tc-labeled iron oxide colloid. The chemical shift observed in the XPS analysis of technegas supports this hypothesis (*3*).

We are also concerned about the possibilities for particle modification by the electrostatic precipitation method used to collect the samples for atomic force microscopy (AFM) study (*1*). We believe it is possible that