Medical Isotope Crisis

TO THE EDITOR: I was interested to read the article on the medical isotope crisis published in the December 2014 edition of *JNMT* (*1*). The subtitle "How We Got Here and Where We Are Going" was somewhat misleading. Some of the detail fell short of outlining on a global perspective (as opposed to a northern hemisphere perspective) where we came from, where we currently are, and where we are headed.

Although I agree that, until recently, global ^{99}Mo production was primarily supplied from 5 sites in Canada, Belgium, South Africa, France, and The Netherlands, the article implied that 100% of ^{99}Mo production came from these 5 facilities. This is not the case either now or in the past. Indeed, Australia has produced ^{99}Mo for many decades through the old HIFAR (High Flux Australian Reactor) and more recently the OPAL (Open Pool Australian Lightwater) reactor mentioned in the article (*1*). Historically Australia has produced 8% of global ^{99}Mo production, and this proportion is increasing with growing demand, particularly in the United States. OPAL-produced ^{99}Mo is attractive because it uses not just low-enriched uranium (LEU) targets as mentioned in the article (*1*) but also LEU fuel—the only ^{99}Mo globally that is classified LEU/LEU. Argentina also uses LEU targets to contribute 1.5% of global demand for ^{99}Mo. Moreover, there is ^{99}Mo production for local and regional use (and hence the data are not as readily available) in Poland, Indonesia, and Russia.

This information is important to discuss because it not only provides a more representative insight into where we have been but also better informs on where we are going. As previously published in *JNMT,* the ^{99}Mo crisis is less a global concern than a northern hemisphere concern (*2*). There has been recent momentum toward cyclotron-produced ^{99m}Tc and ^{99}Mo, and this represents but one solution for those countries where there are chronic supply disruptions. Nonetheless, there is significant ^{99}Mo production capacity, and commissioning of ^{99}Mo extraction and generator production facilities using imported ^{99}Mo target plates is an important strategy for ongoing sustainability.

Although I do not disagree with the perspective of the author, I do believe the above points provide important perspective on this important debate.

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REPLY: I would like to thank Dr. Currie for his interest in my recent *JNMT* article (*1*). He is correct in pointing out that the article has a "northern hemisphere" perspective, which in reality reflects the major sources of supply and demand for ^{99}Mo. He also correctly points out the fact that the OPAL (Open Pool Australian Lightwater) reactor supplies a not-insignificant source of approximately 8% of the world demand for ^{99}Mo, some of which is shipped to the northern hemisphere. There was no intention of negating the role of the many regional reactors; rather, the intention of the article was to highlight the nonreactor alternatives under development, which are designed to help wean the world off our current paradigm of reactor-sourced, and thus government-subsidized, isotope production.

As I stated in my article, "The existing infrastructure of large reactors will be upgraded to increase their production capacity, which should cover the short-term concerns." Although not explicitly stated, the Australian Nuclear Science and Technology Organisation (ANSTO)–OPAL reactor was inferred in this statement, especially since there are plans for upgrading this reactor with a goal of meeting about 30% of the world demand with perhaps future increases.

All will agree that the cessation of the ^{99}Mo production at the NRU (National Research Universal) Reactor (or any of the current suppliers) in 2016 represents a major concern and will lead to supply shortages (*2*). These risks will remain as long as the world maintains a centralized production model in, and an aging infrastructure for, a short-lived radioactive product. The supply of ^{99}Mo is, and will continue to be, fragile. The search for alternatives to ^{99}Mo/^{99m}Tc has been a priority, and this article was aimed at showing that even several efforts (including reactors) are potential solutions on a regional, national, and perhaps international level.

I would like to emphasize that there have been several recent developments in "nonneutron" production methods of both ^{99}Mo and ^{99m}Tc as highlighted in the original article. In addition to the activities at MURR (Missouri University Research Reactor), contracts between NorthStar and SHINE Medical Technologies with large-scale private-sector partners provides for avenues to decentralize supply, at least in North America. Also, significant developments in Canada toward direct-cyclotron production of ^{99m}Tc add to the mix of options. The two Canadian groups have demonstrated multicurie production of ^{99m}Tc, sufficient to supply urban centers on a daily basis ($>$1.10 TBq, 30 Ci/irradiation) (*3*). Such solutions enable a decentralized production model with the potential of maintaining interregional redundancy to help stave off future widespread supply shortages. Those wanting to be in control of the reliability of their own supply will have options.

In closing, it is my hope that readers will come away from these articles and opinion pieces with the impression that there remains a significant risk in the existing ^{99m}Tc supply chain, and concern about the viability of an aging global reactor infrastructure should be taken seriously. With the development of several alternative production methods from many sources (neutron-, proton-, and electron-based methods included), there is optimism that a full-cost-recovery solution exists and that the future of isotope production will be dictated by a free market, unperturbed by subsidy.

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