Patients Wait - Hopes Deteriorate

The Importance of Isotope Supply in Nuclear Medicine

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For many, the word "nuclear" strikes fear into their hearts. Their minds shut out any good that can come from it as they begin to relive global nuclear tragedies one by one. But for Jo Gates, a 41 year old woman who has survived cancer, "nuclear" means life. "I was only 39 at the time of my breast cancer diagnosis, so it came as quite a shock to say the least," said Jo. Because she was young, and had no history of the disease in her family, she underwent aggressive treatment (Pink Ribbon). From the very beginning of the process, radioisotopes were in use. Had it not been for the medical imaging diagnosis (using technetium-99), Jo would not be in nearly the same condition she is in today, if even alive if it were not for the diagnosis. The role nuclear medicine has played in her life has truly sustained her life to say the least, and has done all that and more for the rest of the global population.!

Unfortunately, we hear the word "nuclear," and immediately think of Hiroshima, Nagasaki, and Chernobyl. But in reality, nuclear materials have helped save the lives of more than 30 times as many people per year as the 1,225,000 that died or were injured in those three tragic events combined (Death Toll). In fact, nuclear medicines are used in more than 25 million surgical procedures every year, and other nuclear materials, specifically technetium-99, is used in an astonishing 30 million diagnostic procedures per year. This includes 80% of all image testing in the medical field. Other radioisotopes are used all around the world in another 55 million diagnostic tests that are conducted on blood samples when the patients aren't even present, and thus, the patient is not in any way exposed to radiation (World Nuclear).

If nuclear isotopes are so fantastic, what's the problem? Why should we even be worried about this stuff? What's the catch?

Back in 2009, two of the biggest nuclear research reactors shut down, and they just happened to be the two that produced most of the world's supply of technetium-99. Hospitals world-wide moved to the edges of their seats, because this substance is needed for diagnostic tests 70,000 times a day. This radioisotope is injected into patients' bloodstreams and carried to specific locations or organs in the body. Doctors can easily view the image, and are then able to detect and begin to treat diseases that they may have never been able to identify without the technetium. These doctors rely on a constant supply of nuclear isotopes, but run into a serious problem. Technetium is derived from a substance called molybdenum, or Mo-99, which has a half-life of only 66 hours. Commonly, hospitals receive paint tin sized cans called "moly cows" that contain Mo-99. As the Mo-99 slowly decays into technetium, hospitals are then able to flush the technetium out, or "milk" the moly cow for up to two weeks (Testing Crisis). The technetium itself has a half-life of just 6 hours; while the substance is only active for such a brief period that patients receive minimal radiation, any delays in shipment or misuse of this substance result in the delay of treatments and diagnoses (Save Your Life).

While the need for a constant local supply cannot be overlooked, the overall production itself of the substance is predicted to drastically drop. The United States receives about 60% of its Mo-99 from Chalk River, a nuclear plant in Canada. Chalk River produces one-third of the world supply of this substance, but is scheduled to cease all nuclear isotope production in 2016. The Petten reactor in the Netherlands produces the other 40% of the United States' Mo-99 (Save Your Life). It too is scheduled to cease production in the next eight years (Testing Crisis).

Currently desperate for another source of Mo-99, because 100% of the incoming molybdenum will be nonexistent, the U.S. has had to consider other methods of production. At the moment, our country has no isotope production capacity. The United States has been completely reliant on other countries for Mo-99. On the bright side, nuclear physicists are working tirelessly in Australia to make improvements to the OPAL reactor. If all of the changes/ upgrades are completed and are successful, the reactor will quadruple its current capacity. In the end, the OPAL reactor is predicted to provide one quarter of the entire world supply of molybdenum (Testing Crisis).

The United States has also decided to stop exporting large amounts of HEU (highly enriched uranium) due to the threat of terrorism, and resort to the production of LEU (low enriched uranium). The switch in material compatibility and technology upgrades required to work with LEU has proven to be very costly through some studies conducted by the NEA. By 2020, reactors will have to make do with LEU, resulting in an 8% increase in price on the radio- pharmacy end. But, by the time this cost makes its way upstream and reaches the processing end, the price hike will be around 40%. These ridiculous jumps in price will more than likely also bring an end to the government subsidization of the production. Researchers and nuclear physicists alike are preparing for this hike in a few ways in order to ensure the stability of a much needed isotope supply (Market Impacts).!

A Canadian program, TRIUMF, has proposed a "more economical" solution that will produce relatively no nuclear waste. Company head, Paul Schaffer, envisions a cyclotron model that would not require reactors or uranium at all. In his model, a beam of accelerated protons would shoot into a target of Mo-100, creating technetium-99 directly. Technetium's 6 hour half- life prevents much transportation; one could cover only a 250 mile radius. The idea is to have lots of cyclotrons distributed among major urban areas. If this were the case, major blackouts or a non-functional cyclotron would be the only thing standing between a patient and the nearest hospital - and assuming that there is another within traveling distance, there would still be hope for patients in need (Testing Crisis).

After the suspension of Dutch and South African operations, a European industrial group, the Association of Imaging Producers and Equipment Suppliers (AIPES), said the companies involved had initiated "all possible necessary coordinated actions in order to mitigate the risks for the security of supply" and had activated reserve capacity wherever possible (Incidents Stretch). The United States, which has recently had no production capacity of its own (as there are not production reactors in the country) has even begun research on its own domestic isotope supply (Save Your Life).

All of the pressure to come up with sources for these isotopes has shocked the medical field. "It's possible that some deaths could occur," Michael Graham, M.D., president of the Society for Nuclear Medicine, said. "Some people will be operated on that don't need to be, and vice versa." Without the much needed isotopes, important imaging cannot be done (Save Your Life). The imaging can all but remove the need for exploratory surgeries! But without the isotopes, there could be some unnecessary operations, and some that simply don't happen. People's lives are at stake, and there's only so much time left before the world's hospitals find their "moly cows" empty, without a refill waiting.

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