GLOBAL HEALTH

Radiation Oncology in Africa: Improving Access to Cancer Care on the African Continent

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Introduction

Although many oncology professionals are interested in international outreach, a commonly held belief is that radiation oncology cannot be part of that service due to the high cost and static nature of the equipment used to deliver radiation therapy. There are, however, outreach avenues available today for radiation therapy through both nonprofit and governmental agencies. One of the areas in greatest need of service is the African continent. In many parts of Africa, there are fewer than 1 teletherapy unit per 10 million people. While there is much work left to do, organizations such as Radiating Hope (1), individual radiation oncology departments, and international organizations are currently trying to bridge the gap between patient needs and availability of high-quality radiation therapy in Africa.

Despite the obvious interest in global outreach among oncology practitioners, many erroneously consider radiation oncology to be a discipline which is not amenable to international service endeavors or outreach because of the high cost and technical complexity of linear accelerators and modern brachytherapy equipment. Several efforts have been made, however, to address the need for high-quality radiation therapy in developing parts of the world. One of the areas of greatest need is in northwest Africa, where the ratio of teletherapy units to people is 1:10 million.

In December 2012, a delegation of radiation oncologists, residents, and physicists altered our specialty’s stereotype by embarking on a medical mission to the city of Dakar, Senegal, in West Africa. The parent organization for this trip was Radiating Hope, a nonprofit organization whose mission is to update and provide radiation equipment to developing countries and to advance cancer care in those countries. Together with faculty support from the University of California San Diego, as well as other academic and private radiation oncology centers, Radiating Hope organized a mission with the primary objective of providing Senegal with its first high-dose-rate (HDR) brachytherapy afterloader. The HDR afterloader was procured through a private donation by a clinic in New Jersey and corporate sponsorship by Nucletron (Veenendaal, the Netherlands) to upgrade the machine. Multiple private and academic institutions donated implements such as brachytherapy devices, equipment, treatment planning software, and other supplies.

It is hard to overstate the potential impact of oncology outreach efforts as cancer is a rapidly growing cause of death in Africa. In 2008, 542,000 deaths were reported on the continent, which is projected to double by 2030 (2). If social...
habits such as increased smoking and alcohol consumption accompany further economic development in Africa, these numbers could rise to even greater levels. The number of new cancer cases worldwide per year is also estimated to increase to approximately 15 million by 2015, two-thirds of which will occur in developing countries (3), shifting the proportion of cancer cases occurring in the developing world from just over half to greater than 70% by 2030 (4, 5).

It is estimated that less than 25% of the population of developing countries has access to potentially life-saving radiation therapy (6). Among the obstacles is lack of radiation equipment, which poses a great barrier to cancer care in developing nations (7). An acceptable worldwide standard for cancer care is that 1 megavoltage radiation machine be available for every 120,000 to 250,000 people living in a region (8, 9). In Africa, which has the highest number of underdeveloped nations in the world, each megavoltage and brachytherapy machine serves millions of people, and some countries have only 1 megavoltage machine for more than 17 million people.

Megavoltage machines in Africa

Radiation therapy megavoltage machines are present in only 23 of 52 African nations. Twenty-eight countries have no data for the availability of radiation therapy equipment. Of the megavoltage machines, 32% (88 machines) are cobalt teletherapy machines, and 68% (189 machines) are linear accelerators. Information regarding the availability of equipment is maintained through Directory of Radiotherapy Centers from the International Atomic Energy Agency (IAEA) regional and African and interregional project reports (10, 11). There are 58 conventional simulators and 36 computed tomography (CT) simulators. The number of megavoltage machines per million people is represented graphically in Figure 1. Of the 23 countries with radiation availability, 8 countries had a person-to-radiation machine ratio of more than 10 million:1 (12).

Lack of access to care highlights an unfortunate irony with international cancer care. Whereas developing nations have an increasing incidence of cancer, as well as a relatively higher incidence of malignancies for which radiation is the primary and integral modality (eg, cervical cancer, gastric cancer, pediatric cancers), access to radiation oncology is hampered by both scant availability as well as financial and travel limitations in these countries (8, 13).

Brachytherapy in Africa

Brachytherapy services are available in fewer than half of African nations (11). Of the 20 countries with brachytherapy, both low-dose-rate and HDR brachytherapy delivery are used roughly in equal proportions in Africa. It has been estimated that Africa is functioning at 25% of its potential treatable capacity for cervical cancer alone (11). Cervical cancer is a disease that receives clear benefit from brachytherapy, transforming it into a potentially curable disease. Additionally, brachytherapy has advantages of lower cost and relative ease of installation (8, 12, 14). Because of these advantages and because cervical cancer is a leading cause of death in Senegal, the objective of Radiating Hope’s delegation was to provide a brachytherapy afterloader for expedited use in Senegal. Because the 2 radiation oncologists in Senegal have had brachytherapy training, the HDR equipment was able to be used immediately.

Radiation: A cost-effective therapy

Despite the significant initial investment to build a radiation facility, radiation therapy is a cost-effective form of both curative and palliative cancer therapy (15). Cost analyses have demonstrated that 1 fraction of palliative radiation therapy is more cost effective as a treatment for bone metastases than either chemotherapy or even narcotic medication (7, 16).

Cost-effective aspects of radiation therapy include the fact that patients are treated as outpatients, buildings and equipment have a long lifespan, and the return on equipment investment is high. The cost of an entire course of radiation therapy in Senegal is $300 regardless of duration or fractionation of treatments. Despite this minimal cost of treatment, many patients in Senegal cannot afford radiation therapy and are never treated.

Addressing the rising demand of developing world cancer therapy

The lack of radiation therapy machines and specialists makes it difficult for people with cancer to get the care they need. For example, Senegal is staffed with 2 radiation oncologists and 3 medical physicists. This radiation team currently treats 50 patients per day, 40% of whom have cervical cancer. One of the potential solutions to ongoing cancer treatment training in developing nations may be the development of the Cancer Expert Corps at the US National Institutes of Health. Advocates for this program include C. Norman Coleman, MD, and Bhadrasain Vikram, MD, with the Radiation Research Program, who are helping design a system in which grant dollars may be available to help support tenured-track physicians’ efforts to maintain education and training ties with international partners in developing countries (17). In the opinion of many policy makers, ongoing active ties between international treatment facilities and centers of excellence in the developed world are critical to long-term success, including treatment efficacy, safe treatment for patients, and suitable work environment for staff.

The difficulties of travel in developing countries contribute to the poor access to cancer care. Patients who are candidates for radiation therapy are often required to travel great distances. Analysis by the Surveillance, Epidemiology, and End Results (SEER) cancer registries
showed that greater travel distance to a radiation oncology facility decreases the likelihood of the patient undergoing radiation treatments, even in developed countries (8, 18); and yet, many patients in Africa are required to walk several hours each way for medical evaluation and/or treatment. These patients present with more advanced cancers than do patients in developed nations, and many patients, unfortunately, do not receive any treatment at all. A study comparing presentation of breast cancer patients noted that 50% to 80% of patients in low- and middle-income countries presented with advanced stages compared with 15% in high-income countries (13).

Cancer care in Senegal

Senegal has a single cobalt teletherapy unit that was donated to the country in 2003. Although the need is significant within Senegal alone, over 25% of the patients treated with this unit travel from neighboring countries to receive radiation therapy because of a lack of cancer services in their home countries. The addition of HDR brachytherapy is expected to increase the number of patients under treatment and convert some palliative care cases to definitive radiation therapy, especially in the case of cervical cancer.

Need for radiation therapy

Although the number of cancer diagnoses in Senegal and other parts of Africa are likely underestimated due to poor tumor registry, there are 1100 documented cases of cervical cancer annually in Senegal, with 800 recorded deaths. Our delegation learned that most cervical cancer patients in Senegal receive concurrent chemoradiation with 45 Gy to the pelvis, followed by a 15-Gy external beam boost to gross disease. As many readers recognize, a critical dose of 85 Gy is needed for definitive treatment of cervical cancer, which is unattainable using a cobalt teletherapy system due to normal tissue dose constraints of the rectum, bowel, and bladder. The goal of the Radiating Hope 2012 expedition was to implement the first HDR brachytherapy treatments in Senegal to help shift cases from palliative to definitive treatment.

To prepare for the expedition, several months of preparation were required including multiple site visits by our physics team to work with the Senegalese physics staff to prepare for installation and commissioning of the HDR afterloader. The team of radiation oncologists then visited Senegal to provide didactics, deliver equipment, and provide hands-on training. Radiating Hope’s efforts were further expanded with help from radiation equipment manufacturers and the IAEA with additional training (19). After
overcoming several obstacles together, the Senegal team was able to treat cervical cancer with curative intent by using HDR brachytherapy for the first time. At more than 1 year since installation, the Senegal site has now independently treated many women with HDR brachytherapy. To support this and other future sites around the globe, Radiating Hope is continually accepting used equipment and will provide a tax deduction for any piece of equipment donated.

Call to Action

Dr Margaret Chan, Director-General of the World Health Organization said, “Cancer is a complex disease and must be tackled on multiple fronts by multiple partners (20).” Multiple partners include different nonprofit organizations, academic centers, private cancer centers, and industry, all with the common goal to advance cancer care in developing countries. Many organizations are working to improve cancer therapy in developing countries. The efforts of Radiating Hope in Senegal is just one of the many examples of an organization taking action to advance cancer care in a developing nation. The fact is, medical missions in radiation oncology are possible and desperately needed. A global call to action against cancer in low- and middle-income countries is emerging, led by international agencies, academic institutions, and nongovernmental organizations (4). Examples of other exemplary programs include IAEA’s Technical Cooperation programs (6, 16), the University of Pennsylvania’s efforts in Botswana, and the American Society for Radiation Oncology/American Residents in Radiation Oncology’s (ASTRO/ARRO) Global Health Scholars Program (GHSP), among others.

The efforts of these and many other groups not mentioned in this article are tackling Dr Chan’s challenge by beginning to provide meaningful and ongoing radiation oncology-specific outreach to areas in need of improved oncology care.

Conclusions

It is not an exaggeration to say that cancer represents an imminent crisis for developing countries. Radiation therapy is a cost-effective means of treating cancer and will substantially eliminate the cancer burden if appropriate investment is made. The availability of radiation equipment in Africa, however, is far below the worldwide standard, with millions of people geographically assigned to and unable to be truly served by 1 megavoltage machine. This sheer lack of accessibility to radiation equipment precludes any chance of treatment and cure among patients in these developing countries, allowing cancer deaths to continue to disproportionately affect the poorest people in the least developed countries. More initiatives from public, private, and governmental organizations are desperately needed to help stem the inevitable negative outcomes of this situation.

References