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Growth of PET-CT Imaging and its Perspective

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Positron Emission Tomography (PET)—computed Tomography (CT) is a hybrid fusion imaging modality giving functional information at the molecular level along with structural delineation by CT. This fusion imaging has been used in cancer patients, neuroimaging, cardiac diseases, and some medical cases since the 2000s. PET-CT is becoming an integral part of the management of cancer patients. This imaging facilitates baseline cancer staging, observing therapy response and recurrence, and is used for the planning of radiotherapy.

We might say that the PET era began with the establishment of the medical cyclotron in 1938 by E. Lawrence and Livingston at the University of California, Berkeley. Then, research was continued with positron-emitting tracers such as 11C, 13N, 15O, and 18F. Eventually, research on PET tracers and imaging devices has been evolving in different institutes all over the world. The dedicated efforts of physicists, scientists, chemists, biologists, and physicians for 60 years were behind the establishment of PET, from research to recent PET-CTs in clinical use (1, 2).

The PET imaging modality was first developed in 1975, mostly for research purposes, and it was used in clinical settings in 1991 (1, 2).

The prototype PET/CT scanner was built in 1998 by CTI PET Systems in Knoxville, TN (now Siemens Molecular Imaging) and subsequently clinically evaluated at the University of Pittsburgh (2). Since 2001, PET-CT has been available for clinical use in the USA and Japan on a small scale. Then physicians have experienced tremendous growth in this imaging modality in the last two decades worldwide.

In Bangladesh, a private hospital in Dhaka first established a medical cyclotron in 2009-2011, and simultaneously they started PET-CT imaging modality in 2011. In the government sector, the National Institute of Nuclear Medicine & Allied Sciences set up PET-CT and began functioning in January 2016.

By January 2025, in our country, we have a total of 29 nuclear medicine institutes or centers. Among them, 22 are under the Bangladesh Atomic Energy Commission (BAEC), one is under the Combined Military Hospital (CMH), and six are private. A total of 11 PET-CT establishments; among them, six are public PET-CT facilities, of which five centers are under the BAEC and one is in the CMH. Presently, six private centers have PET-CT facilities. Approximately 200 nuclear medicine specialists are in Bangladesh.

In 2023 in Bangladesh, in eight PET-CT establishments, a total of 7643 scans were done. The annual scans per machine vary from 493 to 1787, and on average, about 955 scans were performed per center per year. The population of Bangladesh in 2023 was 171,466,990. PET-CT examinations per 1000 population were 0.04, and PET-CT units per 10,00,000 were 0.04 (one PET-CT scanner per 1.55 crore population). Further, four centers were established from January 2024 to January 2025.

In 2022, in Bangladesh, the new cases of cancer patients were 167,256, and the 5-year prevalent cases were 345,337. If one cancer patient needs at least 3 PET-CT scans for his cancer management during baseline staging, therapy response, and to see a recurrence. We can imagine how much PET-CT scans are needed in this cancer scenario in Bangladesh. If we consider, 7643 scans were done for 345337 cancer patients. For 100 cancer patients, 2.2 PET-CT scans were available in a year. 2023. We can assess the scarcity of the PET-CT facility. There will be an increment of the total number of PET-CT scans by adding scans of four new centers by 2025.

The data of PET-CTs and related issues of some developed countries have been mentioned here. We know that the volume of PET-CT scans varies across countries

for reasons that are not related to population size and depend on the economy and reimbursement policy.

In the year July 2019–June 2020, in Australia, the total number of PET-CT and PET scanners was 92, the number of scans was 118,909, the examination per 1000 population was 4.6, PET-CT and PET units per 1,00,0000 population was 3.6, and the population was 25,693,05,910 (3).

In the same year in Canada, the total number of PET-CT and PET scanners was 57, the number of scans was 125,775, the examination per 1000 population was 3.3, the PET-CT and PET units per 1,00,0000 population was 1.5, and the population was 38,000,056 (3).

During the year July 2019–June 2020 in England, the total number of PET-CT and PET scanners was 71, the number of scans was 1,995,857, examination per 1,000 population was 3.5, PET-CT and PET units per 1,000,000 population was 1.3, and the population was 56,550,000 (3). In 2020 in Japan, the number of PET-CT scanners was 594, and the population was 126,146,000.

In the USA, in 2020, the number of PET CT scanners was >1600, the total number of examinations was 2,220,330, the population was 329,500,000, and the scan number per 1000 population was 6.7. The prevalence of cancer survivors in the USA in 2022 is 18,100,000. By 2025 the number of PET-CTs will become 2500 in the USA.

In India, PET-CT started in 2002, and in 2015, the number of PET-CTs was 110. By June 2023, India had 506 nuclear medicine centers having 437 PET-CT scanners (including five PET-Magnetic Resonance Imaging) and 24 functional medical cyclotrons. (4, 5). The population of India in 2023 was 142.9 crore (3 PET-CT scanners per one crore population). About 1425 nuclear medicine physicians are working in India. We are amazed to watch the tremendous rising curve of PET-CT facilities in our neighboring country. According to the reports of the Atomic Energy Regulatory Board, 86% of nuclear medicine centers in India were private in 2018. The estimated number of cancer cases was 14,969,72. They expect the number of PET-CTs will be 1000 within 10 years (4).

We have observed the growth of PET-CTs in Australia; they had 12 PET-CT scanners in 2005 for about 20 million people and have 105 PET-CT units for 27 million people in 2025.

In Bangladesh in 2015, we had only two PET-CT scanners; one private and one public establishment, and 11 scanners by 2025. Now we have two medical cyclotrons; the second one (18 MeV) was established in 2020 at NINMAS.

Luckily, in October 2002, I witnessed the installation of the first PET-CT scanner at the National Institute of Radiological Science, Japan. I was taken aback by the experience and believed that setting up a costly cyclotron and PET-CT machine in Bangladesh would not be possible anytime soon. I was young, but I did not have the courage to dream. I dare to dream now as I get older and witness the rapid advancement of technology.

In January 2025, Bangladesh has 11 PET-CT scanners for a population of about 17 million. I hope between 50 and 100 PET-CT scanners will be available in the next ten years to help manage cancer patients in our nation. Who knows, the number might surpass my dream or guess.

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