ESTABLISHMENT OF THE CYCLOTRON FACILITIES IN BANGLADESH – PRESENT STATUS AND EXPERIENCES

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Cyclotron is a device that accelerates charged atomic or subatomic particles in a constant magnetic field. This type of particle accelerator was very first developed in the early 1930s by two American physicists Ernest Orlando Lawrence and M. Stanley Livingston at the University of California, Berkeley.

In Bangladesh, the first medical cyclotron was installed in a private hospital named United Hospital, Dhaka at 2011. This one is the only cyclotron (9.6 MeV energy from GE) which was supplied the PET tracers to all PET-CT establishments since 2011 to 2020. United Hospital operated the cyclotron only two days per week. This cyclotron managed the demands of PET tracers in the country at that period.

Considering the necessity of a cyclotron, the government took the initiative to establish a cyclotron facility under a government ADP project at the National institute of Nuclear Medicine & Allied Sciences (NINMAS), Bangladesh Atomic Energy Commission (BAEC). Selection of the type of cyclotron to set up was crucial. Accumulating the information regarding expenditure and time required, expert opinions from IAEA were sought, then the decision was finalized to have a cyclotron of around 16-20 MeV within our budget. Following completion of the tender procedure, it was decided to install a 18/9 MeV cyclotron from IBA. IBA Cyclone 18/9 is a dual particle accelerator/cyclotron whose proton energy is 18 MeV and deuteron energy is 9 MeV.

After reaching the main equipment of cyclotron and radiochemistry, enormous hurdles and challenges were faced with the placement of a 100 tons crane during the rigging of the cyclotron in the cyclotron bunker due to narrow space in front of the building. Another big challenge was to slide the 27 tons cyclotron in the appropriate place of the cyclotron bunker. Solving these undue and uncalculated issues were time consuming and at last it was possible to rig the cyclotron on designated bunker at the basement of the building. The cyclotron was commissioned and simultaneously the installation of two chillers, four air handling units (AHU), clean room, radiochemistry unit, quality control equipment and radiation safety equipment were completed during that period.

The main objective of this cyclotron establishment is to produce conventional ^{18}F, ^{11}C, ^{13}N and ^{15}O PET radionuclides. This cyclotron has eight target ports. Primarily four target ports have been chosen for the ^{18}F, one for ^{11}C, one for ^{13}N, one for ^{15}O and one for solid target. Presently the cyclotron has been exclusively used for the production of ^{18}F for ^{18}F-FDG PET imaging. ^{18}F- FDG is supplied to four government and two private PET-CT facilities regularly twice in a week.

Establishment of Cyclotron facility at NINMAS was aimed to develop modern services and innovative in both diagnostic and therapeutic service to patients and physical and biomedical research. Regarding human resource development in this filed, IAEA accepted a TC project title: “Developing Human and Infrastructure for Cyclotron Based Diagnostic Positron Emission Tomography Radiopharmaceutical Production and Radiation Treatment Facilities for Cancer Patients (BGD/6028)” for the year 2020-21. The main objective of this project is that the skilled and dedicated multidisciplinary professionals with a strong technical knowledge of cyclotron-based PET

Radioisotope production as well as synthesis and quality control of various PET radiopharmaceuticals are developed in Bangladesh.

Both two Cyclotron facilities so far were established in Dhaka, the capital city of Bangladesh. Considering the demand of PET-CT scan and the necessity to expand the facilities outside of Dhaka, the government has taken the initiative to establish another three cyclotron facilities at different area of the country. It is expected that within two years these facilities will be established.