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Patient Trend of FDG PET-CT Imaging at NINMAS: Working Experience of First Six Years

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Fluorodeoxyglucose Positron Emission Tomography-Computer Tomography (FDG PET-CT) is a recent and developing technology in Bangladesh. The cornerstone of the PET-CT scan is laid by the discovery of the Warburg effect, followed by the development of the fluorinated glucose analogue ^{18}F-fluorodeoxyglucose (^{18}F-FDG) and the invention of positron emission tomography (1). This is a non-invasive molecular imaging technique that uses a single imaging instrument to integrate PET and CT images. PET-CT has given cancer patients a new lease on life, as it gives metabolic as well as morphologic information. Cardiology, neurology, and several infectious and inflammatory illnesses all benefit from it (2). The first PET-CT scan in Bangladesh was performed in a private facility in 2012. It was made available at NINMAS in 2015. Prior to this, patients had to go to other countries for this complex test, which took a long time and costed a lot of money. At present, there are a few government-run hospitals in Bangladesh that have this facility. The PET-CT center at block-F, NINMAS is one such specialized place with the resources to provide state-of-the art correlative imaging technology for diagnosis, staging, treatment and evaluation of therapeutic response of patients. Over the last six years of operation of the NINMAS PET-CT, there has been a significant shift in the pattern of patient management among the clinicians. Conventional methods are steadily being replaced by the currently available high quality anatomical and functional imaging technology that provides a more comprehensive view of a disease process.

This retrospective analysis was conducted to assess the trends of the referrals for FDG PET-CT imaging in oncology and non-oncological diseases.

NINMAS PET-CT report database was reviewed from January 2016 to the end of December 2021. All the completed FDG PET-CT scans in patients were included.

A total of 2402 patients underwent the PET-CT scans for diverse clinical conditions during this time period. The results showed a total of 145 scans were performed for non-oncological purposes. Among the non-oncological group, tuberculosis was the most common. The bulk of the scans were done in oncology which comprised a total number of 2257 patients. Of these, 1087 were males (48%) and 1170 were females (52%). In 2016, the first year of operation of NINMAS PET CT, a total of 228 (122 male and 106 female) patients were studied. Thereafter, the numbers showed 377 patients (182 male and 195 female) in 2017; 242 patients (107 male and 135 female) in 2018; 307 (137 male and 170 female) in 2019; 367 patients (178 male and 189 female) in 2020 and 736 patients (361 male and 375 female) in the year 2021 (Figure 1).

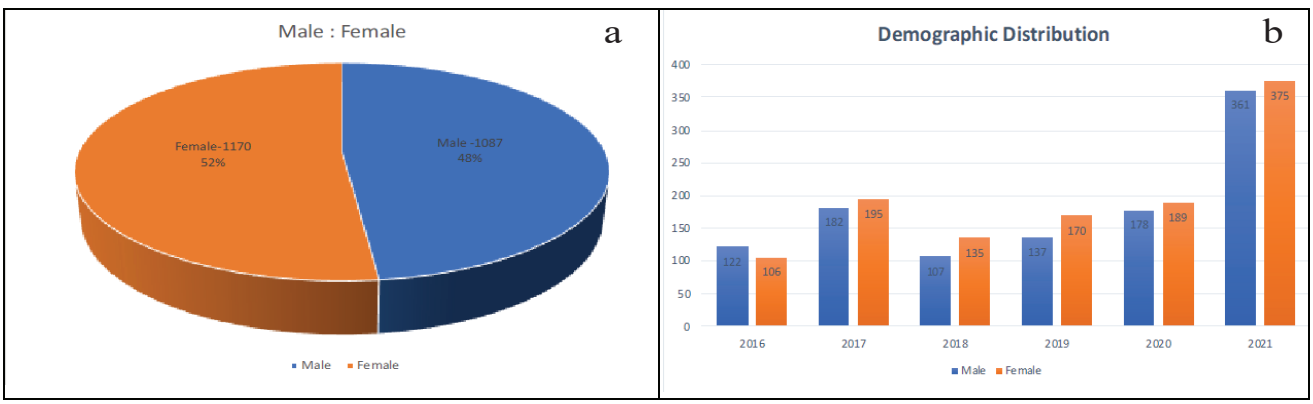

Figure 1: a) Pie diagram showing the total oncological patients with gender distribution b) Demographic distribution of the oncological patients from 2016 to 2021

Distribution of the different oncology patients referred for PET-CT is shown in Figure 2. The most common referral for PET-CT imaging was lymphoma which comprised 27% of total cases in oncology. Carcinoma of breast was 18%, gastrointestinal tract carcinoma was 13%, carcinoma of lung was 8% and carcinoma of female reproductive tract was 6%.

Every year, about 66,000 people in the United States and over 300,000 people throughout the world are diagnosed with NHL (5). In Bangladesh lymphoma also appears to be on the rise; five-year prevalence of NHL and HL were 4.67 and 0.89 per 100,000 (Source: Globocan 2020). This trend in the increase of lymphomas is reflected in NINMAS database too. The

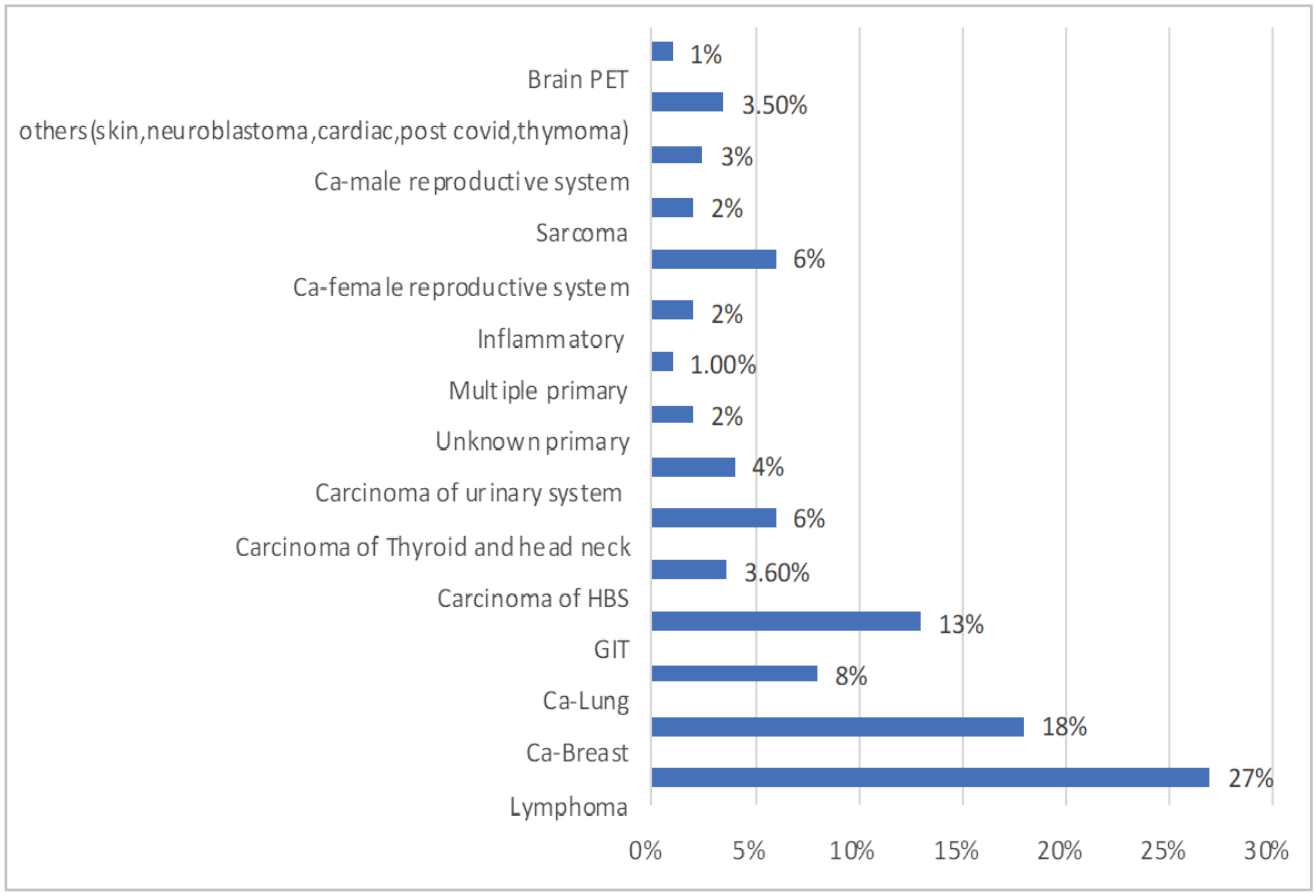

Figure 2: Distribution of referred patients according to the indications

The spectrum of PET-CT imaging in oncology in our database shows the largest number of referrals in patients with lymphoma. This is not unprecedented, because PET-CT is an invaluable tool in staging of lymphomas and is a vital prerequisite for optimum management and assessment of prognosis. A very brief review of the literature on lymphoma shows it to be a diverse group of disease that originates from the immune system's constituent cells or their precursors (3). Non-Hodgkin's lymphoma (NHL) and Hodgkin's lymphoma (HL) are the two primary types of lymphoma. NHL is the most prevalent kind of lymphoma, accounting for about 85% of all lymphomas (4).

^{18}F-FDG PET-CT imaging is universally recognized approach for the treatment of Hodgkin's disease and aggressive NHL. It is necessary for staging, restaging, prognostication, developing effective treatment choices, monitoring therapy, and identifying recurrence (6). Since PET-CT is indicated at different stages of lymphoma to assess disease progression and response to therapy, it appears to be the most frequently imaged group of patients in oncology. Thus NINMAS PET-CT database shows the majority of patients being imaged are patients with lymphoma compared to other oncology patients. Figure 3 shows the lymphoma patient trend.

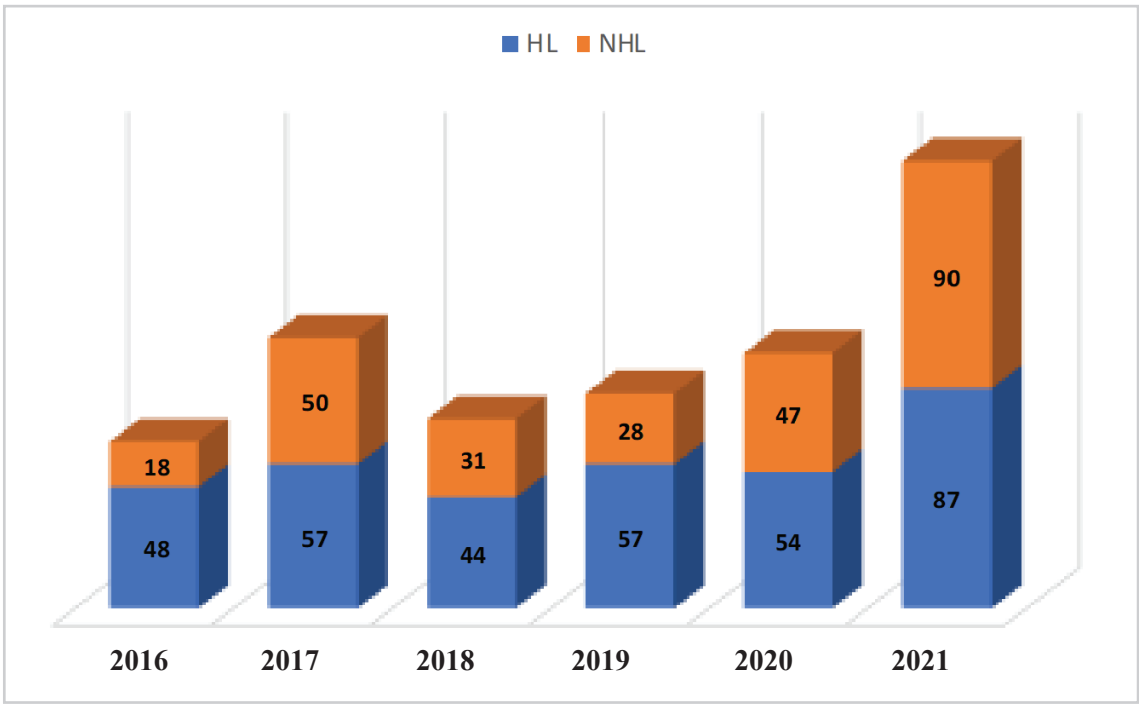

Figure 3 : Distribution of lymphoma patients attending PET-CT division of NINMAS

Lymphoma patients are gradually increasing in number from 2016 to 2021. In 2021, total lymphoma patients were 177 (24% of total patients in 2021); among them 87 were HL and 90 were NHL (Figure 3).

Figure 4 shows the frequency distribution of common cancers. Following lymphoma, the most prevalent carcinomas for which PET-CT was conducted were carcinoma of the breast (18%), gastrointestinal tract carcinoma (13%), carcinoma of the lung (8%), and carcinoma of the female reproductive system (6%). The frequency of PET-CT scans conducted for all four carcinomas has steadily increased over the last six years (Figure 4).

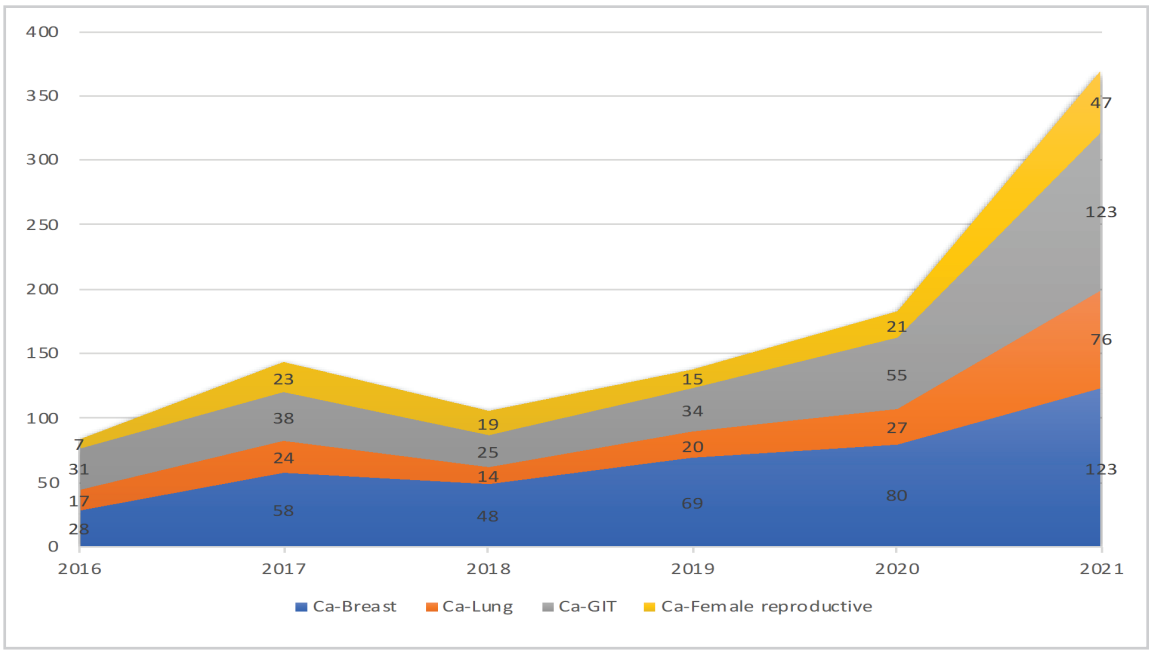

Figure 4 : The frequency distribution of PET-CT was performed for common cancers

Carcinoma of unknown primary (CUP) is defined as a biopsy-proven malignancy whose anatomical origin remains unknown after a thorough diagnostic evaluation. A large number of CUP patients were sent to NINMAS for PET-CT scans. It is speculated that FDG PET-CT may be an excellent alternative to CT alone and conventional magnetic resonance imaging (MRI) in detecting the unknown primary tumor due to its high sensitivity for detecting lesions (7). Figure 5 depicts the annual referrals of CUP patients at NINMAS. Regarding the age of the patients in oncology, lymphoma has a wide range of age distribution. It is seen even below 18 to over 60 years of age but more commonly in 3rd and 4th decade. Other carcinomas are evident in 5th and 6th decades. Large number of patients with breast carcinoma is also seen in 3rd and 4th decades. The age distribution of patients with the most prevalent malignancy is shown in Figure 6.

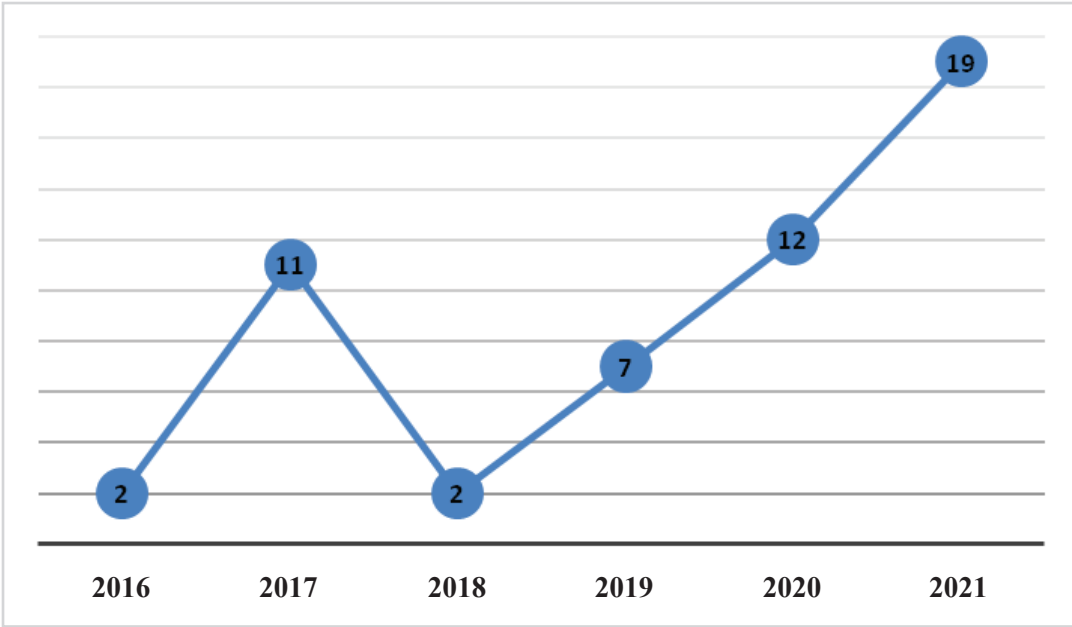

Figure 5 : Distribution of patients of carcinoma of unknown primary

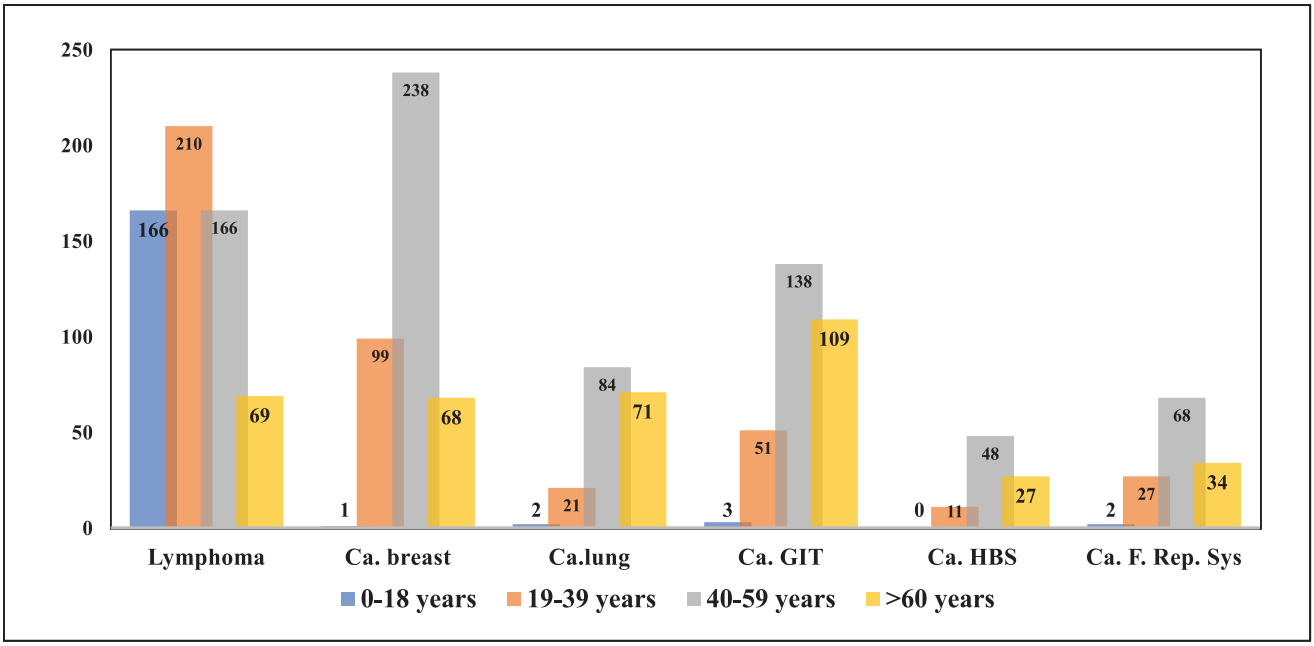

Figure 6: Age distribution of patients with most frequent carcinoma

CONCLUSION

Clinical research data has proven that PET-CT scanning is superior to conventional imaging in the diagnosis and management of various types of cancers. The trend of referrals for PET-CT at NINMAS shows the number of patients was modest in initial years but gradually increased over the last six years owing to two factors: **i)** increasing facility with the construction of the cyclotron, and **ii)** increased awareness of the clinicians as well as patients and attendants. All of these have contributed to an increase in the number of PET-CT scans conducted in NINMAS throughout the first six years.

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