

PRESENT STATUS, FUTURE PROSPECTIVE OF EFFECTIVENESS OF NUCLEAR MEDICINE IN BANGLADESH

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I feel privileged and honoured for inviting me to speak on "The present status, future prospective of effectiveness of nuclear medicine in Bangladesh". I am fully aware of my limitations and height of achievements and greatness which are no match of many stalwarts present over here. I, however, appreciate your generosity and grace and thank you all and particularly professor Munho Lee and his colleagues so much.

Bangladesh, one of the developing countries of Asia and Oceanic regions with a population of ninety million covering an area of 55,558 square miles is situated on one of the largest and most fertile deltas in the world. The rich, alluvial soil and abundant rain and river water are the country's best natural resources.

British colonial rule crippled the economy of the then Bengal, turning a once prosperous economy into one dependent upon foreign markets for its agrarian exports. Then the West Pakistani rule bled the country's resources until war of liberation emancipated it in 1971. By then, however, the economy of Bangladesh has been severely shattered and crippled and in 12 years after independence the nation has managed to keep afloat. The economy is based on health of agricultural sector. There are a few important things to remember when looking into health status and health care in Bangladesh. Of 90 million population 81 million lives in rural areas and 9 million in urban areas. The Physician population ratio in rural areas is 1:27000 with 3000 qualified physician around villages and 1:7,500 in urban areas with 12,000 qualified Physician in urban. About 40% of total population (i.e. thirty six million) are below 5 years age group.

Ninety percent of total population living in rural villages are most illiterates, can not afford decent living, doctors fees, not to speak of buying medicine for sick dear ones. There are rural health centers (upazilla) covering 250,000 population over an area of 100 square miles with medical officer mostly living away from the center.

Forty eight percent of entire population being children are victim of malnutrition, diarrhoea, dysentery, whooping cough, diphtheria, measles, polio, TB etc. Govt. aim of "Health for all by 2000 AD" need to prevent forty three million children dying from these diseases. Annual per capita expenditure on drug is approximately Tk. 10/=(\$0.67) in Bangladesh compared to that of Rs. 7.7 (\$0.90) in India and Rs. 5.9 (\$0.40) in Pakistan, Govt. health center can offer only Taka worth of medicine per head per year.

Myself being one of the members of expert committee with Prof. N. Islam, president of BSNMB as chairman, we had formulated a national drug policy. The drug policy was accepted

by the Govt. and became law in June 1982 under a Govt. Ordinance, Under drug policy all unnecessary useless and combination drugs and drugs of known side effects and doubtful efficacy were banned (total 36 drugs & 1700, brands). Total 250 drugs including 150 essential drugs and 100 restricted drugs for use by specialists only have been allowed for marketing. Of 150 essential drugs 12 drugs are for use by village level health workers, 33 essential drugs for primary health care upto Upazilla health complex level and 105 essential drugs for use upto tertiary level. This has created a great awareness amongst general public about misuse, abuse and over use of drugs and their right. The drug policy has been hailed by people of all walks of life from home and abroad.

The most common diseases are infections and communicable diseases due to lack of pure drinking water, lack of sanitation and communication in villages and function of poverty and ignorance. Most people do not live within reach of modern treatment facilities. The vast majority of births take place at mother's home, in unsanitary conditions, maternal mortality is high due to birth complication and weakness of mothers due to repeated births as well as mishandling in delivery. Birth rate is high (34/1000) (live birth) but death rate is 11.5/100. Majority of the people are malnourished and under nourished, weakened by lack of proper treatment for common diseases. All these diseases (TB, diarrhoea, pneumonia, measles, gastroenteritis etc.) are most virulent either because the pathogen is more lethal in Bangladesh or because victims are generally physically weaker.

These are the conditions in which the country's health systems operate. The health care is delivered by three system: The Govt. and private (allopathic medical system) and private practice (traditional medicine delivery system) and homeopathy system of medicine and 36% healers available in rural areas are unqualified allopaths. Eighty five percent of population go to homeopath followed by spiritual healers, traditional sidwives, and ayurvedic and unani practitioners. Some 80% of ill people who die in rural areas see no allopath healer at all. A certain privileged section of the society who has means to buy medicine and pay doctor's fees are in the orbit of modern medicine.

Cases that can not be handled in Upazilla health center are referred successively to sub-divisional hospitals, district hospitals, and various institutes of higher medicine, medical colleges and private hospitals in the cities.

The constitution of Bangladesh recognizes health care as fundamental right of all citizens. Official charges for patients using Govt. health services are minimum.

Before I talk about nuclear medicine in Bangladesh I wish to present two vignettes to visualize to you the situation in Bangladesh. Vignett 1:

A poor patient at the Upazilla Health complex

There is a big crowd as usual on the morning of the clinic day. A que leads to the door of medical officer's desk. The M/O Arrives looking busy and sits at his desk with a Registered book and prescription papers. As he has to treat at least 100 patients a day he is in hurry. Patients crowd standing beside doctor stating their complaints one by one. The doctor asks name, age and complaints without looking at them. On the paper he quickly scribbles the prescription

without touching or examining the patient. The prescription is for irons and vitamin tablets. Then he calls the next patient. The doctor is embarrassed. What is the point examining another patient when he has only iron and vitamin tablets in his pharmacy stock.

One day, a poor man, owner of a small plot of land came and complained of a distended abdomen. He was also given some iron and vitamin preparations. After a few days his condition is no better.

Some days later he is so uncomfortable and weak that he decides to go to a better hospital. He goes to the local leader for advice and the leader advises him to go to the subdivisional hospital. He sells his rice from the last harvest and goes to subdivisional city. At the hospital, however, his condition gets worse. He is sent to district hospital. He borrows money from local leader to go.

At the district hospital he is told he should go to Dhaka post graduate medicine hospital nuclear medicine unit. He sells his land as he needs money to go to Dhaka where he must wait to get a bed in hospital. On reaching Dhaka he spent all his money waiting for a bed. Then he sent message to his home to send money by selling his cow and chicken, the last resort. He got a bed in hospital and after a few days medical officer of nuclear medicine unit diagnosed him a case of liver cirrhosis and it is incurable. His condition worsens and not long after being admitted to hospital he dies. His wife and five children heard the sad news from a neighbour whose cousin lives at Dhaka and has come up for the day. She is desperate, she has no land, no cow, no chicken and nothing to earn livelihood. She begs for food for herself and her children.

If only he has been told at the primary health care that his condition is incurable his family would not be in such sad straits as today. The poor wife does not know that no doctors had treated her husband like a human being telling him the truth or giving correct diagnosis. If any doctor would have treated him as a human being instead just as another numbered patient and telling him exactly what condition he had and how long he could be expected to live, his wife could at least save the land, cow and children.

The experience of a medical student.

On morning a group of newly admitted medical students file into the class room for their first class. The teacher welcomes them warmly to his profession and asks each of them why they have chosen this profession. The student answers that they want to serve humanity and the distressed. A few say that they would like to secure bright future. The teacher could not be happy with the answers.

The teacher draws a picture on the black board showing a tree. On the top of the tree there are fruits. He tells the students consider the future the fruits are money and top of the tree is the end of your medical course.

The students left the class promising to make a lot of money when they are licenced doctors. Life is easy at the top one notes, then I will have enough money to have a car, television and a pukka house like professors.

With this background we are determined to venture to build an edifice of nuclear medicine in Bangladesh with the hope that if at least one correct diagnosis can be made and at least one

life can be saved it is worth while to practice nuclear medicine which thought might sound as an ivory tower ridiculing the millions poor plight of life.

Nuclear Medicine Programme in Bangladesh: Present Status:

Nuclear Medicine in Bangladesh as in elsewhere plays an important role in bio-medical science for correct diagnosis and therapy of patients and as a precision research tool for bio-medical, biophysical and clinical sciences.

A medicine center established as early as 1962 in the campus of Dhaka Medical college, Dhaka by PAEC was the nucleus of nuclear medicine and centering this institution a steady growth of nuclear medicine programme began in our country. At present an institute of Nuclear Medicine in IPGMR has been established in addition to five nuclear medicine centers each attached to medical college hospitals of Chittagong, Sylhet, Rajshahi, Dinajpur and one would be in Mymensingh soon. These centers are equipped with modest but modern nuclear medicine equipment to render routine diagnostic and therapeutic services to the out door and indoor patients and referral cases.

These institutions are equipped with facilities of rectilinear scanner, gamma counter, gamma camera, three channel renography and thyroid uptake systems and other conventional equipments. Although the facilities are limited diseases of the brain, thyroid, liver, kidney, spleen, bone, GI tract etc are being studied in the Nuclear medicine centers of the country.

The institute of Nuclear Medicine at the institute of post graduate Medicine and Research in addition to routine work facilities has one large field view digital camera with image and data processing system, one three probe renogram, one universal ultra sonogram for abdominal and cardiac echography, *in-vivo* uptake system, microprocessor based gamma camera and other conventional equipment for doing *in-vivo* and *in-vitro* studies. IPGMR center acting as a central co-ordinating body will look after training, quality control in terms of precision and accuracy and preparation of limited items of labelled radionuclides and nuclear medicine activities of the country.

In recognition of usefulness, accuracy and importance of nuclear medicine techniques in diagnosis and effectiveness of treatment and management of patients and research probe BAEC (Bangladesh Atomic Energy Commission) is actively participating in the RCA programme of IAEA for maintenance of nuclear medicine instruments, quality assurance in nuclear medicine and in IAEA research contracts using nuclear medicine for studying tropical and parasitical diseases and therapeutical uses of radioisotopes.

Research Programme of other Institutions

Research, and clinical studies and radioactive tagging of macromolecules by iodination in nuclear medicine and biology are carried out in BIRDEM (Bangladesh Institute of Research and Rehabilitation in Diabetes and Endocrine Disorders), ICDDR (B) (International center for Diarrhoeal Disease, Bangladesh) and Radio Pharmacy unit in the Dept. of Pharmacy, Dhaka University. At BIRDEM, radioimmunoassay on insulin, thyroxine and tissue conversion, uptake and *in vivo*

oxidation etc are carried out with LSC and gamma counter. In ICDDR the nuclear medicine finds its application for studying the effect of dysentery (shigellosis) and diarrhoea on blood and protein loss in stool (using ^{51}Cr serum albumin) during acute stage, hemolysis and its causing factors, red cell survival times, red cell and plasma volume estimation with ^{125}I – serum albumin or using ^{51}Cr , sodium chromate tagged to 4ml of patient's whole blood and re-injecting the isotope tagged blood intravenously to patient (the methodology of ^{51}Cr labelling and counting to be used routinely is as per John Hopkins Medicine Syllabus). While measuring red cell survival the degree of splenic sequestration can also be studied by measuring the rate of accumulation of ^{51}Cr by the spleen as compared to liver and precordium by using detector. Gastrointestinal bleeding using sodium chromate ^{51}Cr tagged to 15ml of patients whole blood can also be studied. Any blood loss in excess of normal value of $1.2 \pm 0.5\text{ml}$ with a range 0.3 to 2.8ml suggests enteric blood loss.

In the department of Pharmacy (Radio Pharmacy & Pharmaceutical unit) *in-vitro* labelling of red blood cells (Erythrocytes) with radiochromium in the chemical form of sodium chromate ($\text{Na}^{51}\text{CrO}_4$) has been under taken. Labelled blood Cells would be used for determining RBC volume or mass, studying RBC survival time and evaluating blood loss. (Abbott Rchromate-51) with the newly acquired gamma counter & LSC of BIRDEM. Further programme on survey of thyroid tests on randomised sample by radioimmunoassay for T_4 , T_3 , ^{131}I -uptake, TRH, PBI in general and for clinical diagnosis of hypothyroidism viz. Graves' diseases, nodular thyrotoxicosis, subacute thyroiditis, thyroxine overdose and primary pituitary and hypothalamic hypothyroidism, lymphocytic thyroiditis, and primary thyroid cancer are being undertaken Presently, for tracing the defect in metabolic pathways in induced diabetic, hypertensive and uremic animals, *in-vivo* oxidation, macromolecular interconversion and synthesis of macromolecules using radioactive biomolecules viz. amino acids, hormones, antibiotics, glucose, acetate etc. are being pursued.

In summary the future perspective of effectiveness of nuclear medicine in Bangladesh is reflected by the present programmes of (1) ultrasonogram of liver, gallbladder, thyroid, arteries, kidneys & gynecologies (2) therapeutic studies including uptake of ^{131}I for thyroid tests, ^{32}P for leukemic, B-radiation for eye, ^{51}Cr for RBC and plasma volume, protein and blood loss, B_{12} absorption test, RBC survival tests, iron absorption and (3) scanning & function of bones, vital organs (brain, liver, kidney, bone (limited areas)) and whole skeletal system and tissues for diagnosis of tumor and cancer.

Though most facilities in the Nuclear Medicine centers are meant for diagnostic purposes, the treatments of some specific diseases viz. thyrotoxicosis, thyroid cancer, vascularized corneal ulcer, malignant and non-malignant diseases of skin, different eye diseases are being constantly offered in these centers. On the average, annually five thousand patients receive medical care from each of these centers. *In-vitro* studies of cancerous cells using nuclear techniques are being pursued.

Still there are areas in paediatric and geriatric nuclear medicine yet to be developed.

Future Prospect:

Future prospect of Nuclear Medicine in Bangladesh, in diagnosis, treatment and prevention of the prevailing disorders and their consequential effects is very bright. These are:

Malnutrition, worm infestation, thyroid malfunction, dysentery, diarrhoea and anemia are disorder of first category prevailing in Bangladesh. Next is diabetes millitus, hypertension, renal function failure, liver cirrhosis, thromboembolism, myocardial infarction, angina pectoris, tumor of liver, gastrointestinal, & brain etc. and their consequential disorders.

Anemia.

Eighty two percent children (with 9.7g/100ml blood Hb) of below 5 years age are anemic. Minimum acceptable Hb level for children of 0-4yr. is 11gm/100ml Hb. Seventy four percent boys and 75% girls of 5-14 year old with acceptable Hb level of 11gm/100ml are anemic (1975-76 Nutrition survey). The incidence of anemia amongst the boys and girls has been increased by 61% and 30% since 1962-64 Nutrition survey, Eighty one percent male adults with Hb level less than 14g/100ml and 70% female adult suffer from anemia (1975-76 Nutrition survey) compared to the incidence of 62% and 55% respectively in 1962-64 survey.

Diarrhoeal diseases, worm infestation, shigallosis, sweat and low vitamin C and A intake are among others contributing factors for anemia.

Enlarged thyroid

Enlargement of thyroid gland was found in high numbers in all group with a striking prevalence over 40% in pregnant female. The usual distribution of goiter is endemic in nature being more common in women and growing children with increased prevalence during pregnancy (stress factor). Cretinism is rare suggesting that this is a "young" endemic areas.

Areas namely Jamalpur, Rangpur and Dinajpur districts have goitre of various types occurring to 80% population there. These areas being highly and frequently flooded, erosion of soil iodide might occur as shown by extremely low iodide content of the soil.

Prevalence of enlarged thyroid gland by age and sex as shown by 1975-76 survey are as follows:

Eight percent male of 5-14 yrs old and 2.2% male of 15 years or above age, 13.4% female of 5-14 yrs or above age, and 31.3% of PL or both (pregnant and lactating) have enlarged thyroid.

Diabetes millitus: 1.5% of adult population of above 34 years old have been suffering from diabetes millitus (so far detected) and are potential candidate for developing secondary diseases of triopathy.

Hypertension and hypertensive heart disease:

2.5% male and 2.8% female have a diastolic blood pressure above 94mm Hg and left ventricular hypertrophy by ECG and prevalence increases with age. An additional 2.1% male and 1.8% female have possible H.H.D with a diastolic pressure of above 94mm of Hg according to 1962-64 survey. Things might have been worsened now.

Left ventricular hypertrophy was more common in males (7.4%) in older age groups of both sexes.

1.8% has arterial extra systole while 1.7% have ventricular extra systols.

Despite intake of extreme low fat and low plasma cholesterol levels 1.2% males and 0.6% female have ECG evidence of myocardial infarction. Hypertension and hypertensive heart diseases are nearly as prevalent as in western countries. Higher plasma cholesterol and blood glucose were more frequent in the group with elevated blood pressure reading levels.

Chronic Cor Pulmonale was the most frequent type of clinical heart disease seen and represents probably a high incidence of lung diseases.

Shigellosis: Shigellosis is an epidemic disease in Bangladesh and mortality of children admitted to ICDDR (B) with shigella dysentery is more than 9% inspite of antibiotic and ORS therapy. Factors causing hemeolysis, blood loss and shock if quite understood mortality could be lowered.

Study documenting stool blood loss, red cell survival time, extent of protein loss and plasma volume estimates by use of nuclear medicine in shigellosis, hemolytic anemia, uremic syndrome and leukemoid reactions will help correct therapy.

Tumor and cancer: The aflatoxin induced gastrointestinal and liver tumor cases are in increase in Bangladesh. Recently brain and epithelial tumor cases are being largely detected. Nuclear medicine methodology could play useful role in this area.

Paediatric and geriatric nuclear medicine:

More than 48% of our population being infant and children and victim of tropical diseases, infection, diarrhoea and dysentery, nuclear medicine could play vital role in diagnosis and treatment of these disorders and consequential disorders, birth defects viz. testicular deformation, abdominal, billiary and cerebrovascular diseases.

In Bangladesh 5.7% of the total population (of which 63% have no land) are senior citizens. With increase of life expectancy the over sixty population has increased by 27% by now. Gradual disintergration of traditional joint family system due to economic crisis, inflation, fragmentation of agricultural holdings and increased population, the traditional social security and dependence of aged on their sons and daughters are disappearing. This growing elderly population deserves national attention and medicare. A group of retired persons formed Bangladesh Association For the Aged and institute of Geriatric Medicine in 1958 to render health care services to the aged on voluntary basis. The Govt. in recognition of the services of the Association affiliated to International Federation of Ageing has come forward with a grant of taka five million for building a permanent complex. The aged are suffering from pleural disorders. Understanding of Geriatric is still insufficient. Geriatrics having characteristics of multimorbidity, atypical symptoms or asymptomatic diseases and microsymptoms. Use of nuclear medicine might serve as objective and quantitative diagnostic procedures. Special attention should be paid in diagnosis of cerebrovascular accidents (15%), pneumonia (12%), diabetes (1.5%), cardiac infarction (44%) and renal insufficiency.

Brain tumor in aged is one of the important asymptomatic brain disorder amongst the aged. Liver disorders due to malignancy is common. Besides metastatic gastric cancer predominate following cancer of pulmonary, colon, gallbladder, esophagus, epithelial tissue, rectum and adrenal.

Thus geriatric nuclear medicine would find an useful tool in diagnosis of geriatric disorder and for clarification of pathophysiological parameters in the aged who because of physical weakness cannot stand the rigor of modern diagnostic tools like angiography, biopsy etc.

In view of the prevalence of these diseases nuclear methods are gaining wider application in both diagnosis and treatment here with more attention receiving from clinical investigators.

The difficulty in getting constant supply of short lived radionuclides have created hindrances in its wider use. Because of non-availability and high prices of short lived radionuclide(s) or kit nuclear medicine is not getting much momentum as desired here.

Each Upa Zilla health complexes (460 health complex) in future would need nuclear medicine facilities for diagnosis and treatment of disorders of brain, thyroid, lungs, kidney, spleen, pancreas, blood and cerebrospinal fluid.

So, there is a great potential for development of nuclear medicine in the field of instrumentations, radio pharmaceuticals and short lived radionuclides preparations and supply in Bangladesh.

The demand for ^{99m}Tc compound viz sulfide, colloids, ferrous oxides, DTPA, gluconate, polyphosphate, human serum albumin for use in study of liver, spleen, bone marrow, lung infusion, brain scanning, tracing of cerebrospinal fluid, visualizing renal morphology and studying renal function, skeletal scanning, blood pool studies including placental localization and spleen scanning is on the increase in Bangladesh.

The techniques use being non-invasive and non-traumatic may find application into a wide spectrum of patients including very sick who could not tolerate the rigors of certain alternative radiological examination.

The problem which seems to be accurate here is shortage of enough trained manpower capable of interpreting the outcome of the results of these techniques. Instruments with greater sensitivity and firm spatial resolution so that small lesions and vibration can be detected is needed as much as skilled and trained manpower to handle various procedures for maintenance of precisions (reproducibility) and accuracy should be taught through workshops and continuing education. Quality control and quality assurance in nuclear medicine should obviously refer collectively to all aspects of nuclear medicine programme including patients scheduling, radiopharmaceutical preparation, instrumentations, data processing and interpretation and record keeping. The success in these aspects will surely determine the future prospect and effectiveness of application of nuclear medicine in developing countries particularly in Bangladesh.

In Bangladesh to give comprehensive guideline and training for quality control in nuclear medicine instrumentation IAEA formed an Advisory group in 1979 and in collaboration with WHO made various recommendations and these were incorporated in Regional Cooperative Assistance (RCA) programme for pacific and south east asian countries in 1981. In 1982 August in its first meeting held in Bangkok it was decided that every RCA country including Bangladesh should have a national quality control workshop to train larger number of participant and to help the country to organize their own quality control programme. A series of workshops under RCA program were held in Thailand, Phillipines, Malaysia and fourth one was held on Nov. 14-17, 1983 in Bangladesh with IAEA & 18 participants from physicians, physicist and Electronic Engineers of BAEC. Thus Bangladesh is on the march of nuclear medicine along with developed institutions of the world.