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A Ten Years of the SPECT System Operation at the Korle-Bu Teaching Hospital

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ABSTRACT

The study was done to have an overview of the benefits or otherwise of the SPECT system in Ghana since 2005. The procedure involve recording the attendance records and the imaging procedure since the inception of the SPECT machine. The objective of this project is to take a clinical review of the operation of the SPECT system since its installation as part of the basic QUANUM process. The data collected and analysed for the stated period has shown that there is a gradual increase in the number of patience. There were 3608 scans procedure in all, with bone scan been the highest with 54.52%, which formed more than half of the study and the least scan being GFR, just about 0.14% of the total study. Together with bone scan thyroid and renal study shows significant attendance ratio of 24.34% and 15.22% respectively. The three together formed about 94% of all the scans at the centre. It is also important to note that iodine therapy together with brain scan were slightly significant with about 3.41% and 1.64%, with the rest showing just about 1%of the total study. More than 56% of the imaging procedure occurred within 2010 and 2014 after initial slow attendance rate. This is because nuclear medicine procedure is gradually gaining prominence acceptance by clinical practitioners and patience. Furthermore, there is a positive correlation between the diagnosed condition of patience and with their present or past occupations and residence.

Keywords : SPECT System, Bone Scan, Renal Study, Thyroid, Diagnoses.

I. INTRODUCTION

SPECT imaging is a specialised nuclear medicine medical imaging technique that uses small amounts of radioactive material that are used mostly to diagnose medical condition and in limited cases for therapeutic cases. SPECT imaging is used in the study of many types of cancers, heart disease, gastrointestinal, endocrine, neurological disorders and other abnormalities within the body [1].

In Ghana, nuclear medicine is mainly used for diagnostic purposes and very few iodine therapy. These are performed as complementary study to other imaging modalities in radiology in order to give a better diagnosis of the extent of a disease-process in the body.

The technique requires delivery of a gamma-emitting radioisotope (a radionuclide) into the patient, normally through injection into the bloodstream. On occasion, the radioisotope is a simple soluble dissolved ion, such as a radioisotope of Tc-99^{m}. Most of the time, though, a marker radioisotope is attached to a specific ligand to create a radio ligand, whose properties bind it to certain types of tissues. This marriage allows the combination of ligand and radiopharmaceutical to be carried and bound to a place of interest in the body, where the ligand concentration is seen by a gamma camera [2].

1.1 Aim

The objective of this project is to take a clinical review of the operation of the SPECT system since its installation as part of the basic QUANUM process.

- This will enable management to improve the process for a better patient's healthcare.
- It is also advice experts at the centre about the various professions in relation to patients' age, occupations, environmental condition and the various scan type distributions for policy decision.

1.2 Basic Literature

SPECT imaging uses the principle of Anger camera which is now the standard clinical nuclear imaging device. Modern Anger Cameras use a lead collimator perforated with many parallel, converging or diverging holes instead of the original pin-hole configuration [2]. This came from the background that Kuhl and Edwards made by presenting tomographic images produced using the Anger Camera [4]. This has become the best revolution in medical imaging today and forms the basis of what is now known as Single Photon Emission Computed Tomography (SPECT) imaging system where tomographic images are acquired and used for diagnosis purposes [5].

The basic principle of a SPECT system is dependent on the rotating camera concept, where a series of planar images are collected, while the camera is rotated through either 180^{o} or 360^{o} around the patient. These planar images are called projection images and are used to create transaxial slice images by filtered back projection of the data into the transaxial plane. SPECT system principle is applied in both whole-body and phantom scanning [3].

A single-photon emission computerized tomography (SPECT) scan is a type of nuclear imaging study, which allows the use of radioactive substance and a special camera to create three dimensional (3-D) pictures of various internal organs of the body. SPECT scan produces images that show the structure and functions of organs. For instance, a SPECT scan can show how blood flows to the heart or what areas of the brain are more active or less active.

In recent years SPECT image study has become popular, this is partly because SPECT scanners have increased tremendously. With a little over 200 scanners in the late 90s, there are over thousands of SPECT scanner all over the world today. Since its inception in the 80s the popularity has increased tremendously in the developed world and gradually in the developing world. SPECT accounts for over 25% of all diagnostic imaging modality and over 55% of a functional image study, in the world. However, there is only one SPECT scanner in Ghana, about 4 SPECT units in West Africa and approximately 18 SPECT units in Africa [1]. With South Africa, Egypt and Algeria accounting for about 50% of these centres.

Even though SPECT imaging was introduced in Africa over decade ago, it has contributed insignificantly to diagnostic imaging modality in the world. However, within the last few years SPECT imaging has now become well-accepted and reliable functional imaging modality for both anatomical and functional evaluation of a specific body organ or body section or even the whole body in Ghana and Africa. It however still lag behind the rest of the world mostly because of availability and cost. Since its inception SPECT has undergone several evolutions, from the days of single head to the latest version of multi-head which has let to greater improvement in clinical diagnostic and therapeutic decisions.

Ghana received its first and only SPECT machine in 2005 and since then it has been used for management of cancer and non-communicable diseases to diagnose different types of diseases. This study looked at the different types of treatment that has been performed at the Nuclear medicine department of the Korle-Bu Teaching hospital from 4th May, 2005 to 31st December, 2014.

II. METHODS AND MATERIAL

2.1 Materials

The materials used were;
SPECT system
Weighing scale
Computer system
Meter rule

Figure 1. SPECT system at the Nuclear Medicine of Korle-Bu

2.2 Methodology

Data was taken from the Nuclear Medicine Department of the Korle-Bu Teaching Hospital from 4th May, 2005 to 31 December, 2014. Two set of data was used, this include;

- Retrospective data of all the scanning process individually counted from the department records manuals since the first scan was performed.
- The second aspect of the data collection was collected during scanning process where patients' information was captured.

Based on the scanning protocols used the data was group as; scan type, scan frequency and patients information

III. RESULTS AND DISCUSSION

The results were tabulated base on these two groups.

3.1 Results

Table 1. Scan Types and Frequency Distribution

SCAN TYPE	NUMBER	PERCENTAGE (%)
Bone	1967	54.52
Thyroid	878	24.34
Lung V/Q	14	0.39
Renal	549	15.22
Liver/spleen	6	0.17
Brain	59	1.64
GFR	5	0.14
Iodine	123	3.41
Gastrointestinal (G.I)	7	0.19
TOTAL	3608	100

Table 2. Relationship between Scan Type and Occupation

SCAN TYPE	SECURITY	FORMAL	INFORMAL	DRIVERS	OTHERS
Bone	390	578	355	241	403
Thyroid	55	127	96	309	291
V/Q	2	2	4	1	5
Renal	101	197	110	67	74
L/spleen	1	1	2	0	2
Brain	14	8	12	18	7
GFR	0	0	2	2	1
Iodine	11	27	18	7	60
Gastro	1	3	0	1	2
TOTAL	575	943	599	646	845
Total %	15.94%	26.14%	16.60%	17.91%	23.42%

Table 3. Relationship between Scan Type and Age

SCAN TYPE	0-20	21-30	31-40	41-50	51 <
Bone	43	189	469	568	698
Thyroid	41	63	208	290	276
Lung V/Q	3	1	2	3	5
Renal	59	79	104	68	239
Liver/spleen	0	0	0	4	2
Brain	3	0	15	23	18
GFR	5	0	3	2	0
Iodine	10	34	19	36	24
Gastrointestinal	1	1	0	2	3
TOTAL	165	367	820	996	1265

Table 4. Relationship between Scan Type and Location

SCAN TYPE	URBAN	RURAL	FIRST CLASSS	SECOND CLASS	OTHERS
Bone	347	167	678	345	430
Thyroid	131	78	342	124	203
Lung V/Q	2	2	5	1	4
Renal	66	34	165	98	186
Liver/spleen	1	0	3	1	1
Brain	13	4	16	14	12
GFR	1	1	2	0	1
Iodine	34	13	18	29	29
Gastrointestinal	2	1	2	2	0
TOTAL	597	300	1231	614	866

4.2 Discussion and Analysis

SPECT provides the ability to often allow the nuclear medicine specialist to more accurately pinpoint the site of any abnormality on a nuclear medicine scan. This may be of particular importance in certain clinical situations, when the interpretation of an area of interest may change depending on its location. There are various scan procedures in nuclear medicine department. However, nine various scanning procedures are performed at Korle-Bu Teaching Hospital.

Table 1 shows the various scans variations at the Nuclear Medicine Centre of the Korle-Bu Teaching Hospital from the 4th of May, 2005 to the 31st Dec, 2014. There were 3608 scans procedure in all, with bone scan been the highest with 54.52%, which formed more than half of the study and the least scan being GFR, just about 0.14% of the total study. Together with bone scan thyroid and renal study shows significant attendance ratio of 24.34% and 15.22% respectively. The three together formed about 94% of all the scans at the centre. It is also important to note that iodine therapy together with brain scan were slightly significant with about 3.41% and 1.64%, with the rest showing just about 1%of the total study.

Furthermore, four different occupations shows prominent in the study. These include the security services both private and public sectors, patients in the other formal sector (outside public and private) of the economy, informal sector and drivers. The rest of the patients were then group and described as others. About 26% of the patients were in the formal sector of the economy which form the highest number of patients with the least being in the security services just about 16% of the patients.

The rest of the patients were evenly spread between the informal sector, drivers and the rest of the patients put together as others with percentage ranging between 16%.60, 17.91% and 23.42% respectively.

The data also shows different patients age groups access the centre with the oldest patient age 88 years old who had bone scan and the youngest was 1 year old baby girl, who had G.I. scan procedure. Two radio tracers are commonly used. With over 89% of the procedure used Tc-99^{m} and just about 11% used iodine.

IV. CONCLUSION

The data collected and analysed for the stated period has shown that there is a gradual increase in the number of patience. More than 56% of the imaging procedure occurred within 2010 and 2014 after initial slow attendance rate. This is because nuclear medicine procedure is gradually gaining prominence acceptance by clinical practitioners and patience. Furthermore, there is a positive correlation between the diagnosed condition of patience and with their present or past occupations and residence.

V. RECOMMENDATIONS

It is recommended that management improve the frequency in the importation of Technicium-99 radio nuclear as the numbers of patients now exceed the monthly importation and an average 12 patients a day.

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