

RADIONUCLIDE EVALUATION OF BRAIN, LIVER AND THYROID DISORDERS IN GHANA

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ABSTRACT

During recent years there has been rapid progress in the study of brain, liver and thyroid with radioisotopes. The contributions are quite significant and in Ghana the number of complaints on these organs' disorders are found to be on the increase. This paper reports data obtained on these diseases and analysis on them to indicate the extent of their incidence in Ghana.

Two methods were employed to obtain the results: a qualitative scintigraphic study of the organs and a radioimmunoassay investigation in the case of the thyroid gland.

The results of a group of 613 patients obtained from 1st December 1989 to 30th July 1990 have been analysed. Of these, 23 reported with liver disorders of which cirrhosis was the main disorder, 275 of the patients reported with brain disorders with Vascular lesion and meningitis being the main disorders. 315 of the patients reported with thyroid disorders with goitre being the main disorder.

INTRODUCTION

The early application of nuclear energy was for peaceful means in medicine and related fields until the Manhattan project which culminated in the production of nuclear weapons. This subsequently over-shadowed the initial gains until the International Atomic Energy Agency was set up by U.N.O to promote and monitor the peaceful purpose.

The application of nuclear radiation in medical diagnosis, research and therapy, classified as nuclear medicine, has advanced greatly over the past decade. Radiation detectors such as scintillation crystals and the liquid scintillation counting systems are highly developed tools to which new types such as the semiconductor and thermoluminescence devices have been recently added. The availability of a fairly large number of potential, labelled scanning agents which get concentrated in specific organs long enough to be detected, led to the visualization of the distribution of

activity within the body.

Some of the methods employed for investigating the localization and confirmation of lesions and the discovery of early metastases are by means of radioisotope scanning through the use of the rectilinear scanner, the Anger gamma camera, and the whole body profile scanner. Other modalities such as computerized tomography, nuclear magnetic resonance, ultrasonography, position emission tomography, single photon emission computerized tomography etc. have rapidly evolved from research curiosity to clinically accepted procedures.

The medical image is a window to the body and no particular modality stands out among others as a definite diagnostic aid. In particular, it may be employed to elucidate the organs' metabolic functions.

Nuclear medicine uses minute tracer doses of various specific gamma ray-emitting radioisotopes. Because of their low radiation dose, multiple compounds can be administered to the patient with great safety and simplicity to differentiate some lesions from others [1]. However, the lack of specificity of nuclear medicine is one of its major draw-backs.

Statistics on the data, obtained from the Nuclear Medicine Unit at Korle-Bu Teaching Hospital [2], have shown that cases of thyroid, brain and liver disorders are on the increase. However, there is very limited report on the various cases encountered in the Unit. Meanwhile there was an old assertion that thyroid diseases such as hypothyroidism are rare in the African [3,4,5].

In this study, most of the patients were referred from the Korle Bu Teaching Hospital, and the rest from other government hospitals and by Private Practitioners throughout the country.

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INVESTIGATIONS

The Brain

Materials and Method

275 patients comprising 192 males and 83 females referred for suspected brain disorders were studied. Their ages ranged between 2½ to 60 years. Initially, 1g of potassium perchlorate was orally administered to each patient to block the thyroid gland against the localization of the tracer [6]. 15 minutes after intravenous injection of about 4.8MBq (140µCi) Tc-99m pertechnetate per kg bodyweight or in some cases with DTPA (Diethylenetriamine Pentaacetic Acid), scans were obtained.

Scanning was done with the M800 Scintikart scanner using a 37-tapered-hole collimator of 9cm focal length. Other settings of the scanner were 20% background subtraction 6m/min speed and 2mm line spacing. In every case 3 views were taken: anterior, right and left laterals. At the start of the scan of each view the ratemeter was calibrated on the hottest spot. The results were interpreted as normal or abnormal.

Results

Table 1 gives the summary of the results. 16.3% of the reported cases were diagnosed as abnormal and made up of 3.6% females and 12.7% males. Vascular lesion and meningioma formed the main bulk of the abnormal cases of 5.7% (females) and 4.1% (male).

TABLE 1: RESULTS OF THE BRAIN SCAN

DIAGNOSIS	NUMBER OF PATIENTS	
	MALES	FEMALES
Normal	166	77
Vascular lesion	9	5
Meningioma	8	1
Subdural haematoma	2	0
Cyst, abscess or cancer	4	0
Hydrocephalus	1	0
Reduction in size	1	0
Pituitary adenoma	1	0

The Liver

Materials and Method

Twenty-three patients suspected of liver diseases were referred for scanning. There were 17 males and 6 females with ages ranging between 21 and 62 years.

Each patient was intravenously injected with about 0.53 MBq (28.6µCi) per Kg body weight Tc-99m sulphur colloid, an Amersham Kit [7]. Twenty to thirty

minutes after injection the scanning was carried out using the same collimator as in the case of the brain. Several views including anterior, right lateral and in some cases posterior were taken. The scan speed and the line spacing were selected in such a way as to obtain an information density of 800/cm² [8]. When radioactivity was greater over the spleen than over the liver, two scans were carried out calibrating at the points of maximum spleen and liver radioactivity respectively. The sternum, lower coster margins and any palpable mass were marked in dark on the scan picture.

Result

78.3% of the patients referred for liver disorders tested positive. Of these 43.5% had cirrhosis and 26.1% had hepatoma or cyst (Table 2).

TABLE 2: RESULTS OF THE LIVER SCAN

Cases	Sex	Age	Palpable	Highly enlarged	Normal Scan	Cirrhosis	Hepatitis	Cs/Cyst
1	M	42				+		
2	M	40				+		
3	M	7			+			
4	M	28					+	
5	F	52		+			+	
6	M	32				+		
7	F	50	+					+
8	M	44				+		
9	F	49						+
10	M	21		+		+		
11	M	38				+		
12	M	55						+
13	F	54		+				
14	M	42				+		
15	F	40				+		
16	M	47			+			
17	M	42				+		
18	M	58	+					+
19	M	62				+		
20	M	48			+			
21	M	38			+			
22	M	58						+
23	F	26		+				

The Thyroid

Materials and Method

The group with thyroid disorders comprised 315 patients, made of 66 males and 249 females. Their ages ranged from 10 to 67 years with a mean of 37.2 years.

Initially about 10cm³ of blood sample was taken from each patient for the *in vitro* analysis using the Amersham Kit [9]. This was followed by intravenous

injection of about 0.53MBq Tc-99m pertechnetate per 1kg body weight. After 15 minutes of administration of the tracer, the thyroid uptake (T_c) was measured as the ratio of activity over the thyroid to that of the thigh [10,11]. This was followed by scanning by first calibrating on the hottest point on the thyroid. Palpable masses were traced and marked black on the scan picture.

The normal range of the thyroid uptake employed was 2.5 to 5.5 [9]. In the *in vitro* tests the normal thyroid hormone ranges (T₃ = 0.8 - 2.7 nmol/l and T₄ = 62 - 165 nmol/l) set by Amersham [9], a radiopharmaceutical centre, were used. These normal ranges compared favourably with those determined in the Unit [2].

Thyroid Results

Table 3 gives the results of the thyroid investigation. The disorders were much more common in females than in males. About 56.5% were diagnosed abnormal with females forming 45.8%. Goitre constitutes 42.5% of the thyroid patients with females forming 35.8%. Hyperthyroidism was diagnosed in 8% of the thyroid patients with females forming 6.3%. Hypo-thyroidism was detected in 10% of the thyroid patients, 8.4% females and 1.6% males.

not differentiate between fluid-filled lesion and solid. These could be best seen by either ultrasonography or computerised tomography.

The thyroid disorders were very high compared with the other cases. Goitre formed the bulk of the thyroid diseases. There was a high number of females with goitre, 28 cases of hypothyroidism and 32 cases of hyperthyroidism were observed in the patients.

Thyrotoxicosis and hypothyroidism have been considered rare in the African [3,4,5]. McGill [3] concluded that hypothyroidism was rare in the African. Trowell [14] in his 29 years' practice in East Africa never diagnosed a case. In 600 thyroidectomy specimen of African patients in Kenya, only in one case was histological features of Hashimoto's disease observed [14]. Meiring [15] reported one case of myxoedema from South Africa. Owusu [3] reported 14 cases of hypothyroidism from 1968 to 1973 at the Korle Bu Teaching Hospital in Ghana.

In his nearly three decades of clinical practice in East Africa, Trowell [14] admits seeing only one genuine case of thyrotoxicosis. Johnson [16] reported 5 cases over a period of 19 months in Lusaka. McGill [13] investigated and treated 23 cases at the Kenyatta Hospital, Nairobi between April 1968 and April 1970. Owusu [4] observed 13 cases over a 4-year period in

TABLE 3: RESULTS OF THYROID DISORDERS DIAGNOSIS

NUMBER OF PATIENTS	EUTHYROID		GOITRE	GRAVES	NEOPLASM CYST, CANCER	NOT LOCALIZED	THYROID-ECTOMY	HYPER-THYROID	HYPO-THYROID
	WITH GOITRE	WITHOUT GOITRE							
MALES	15	32	14	5	0	0	0	5	6
FEMALES	79	105	10	7	19	7	4	27	22
TOTAL	94	137	24	12	19	7	4	32	28

DISCUSSION

Some of the methods employed for investigating the localization and confirmation of lesions and the discovery of early metastases are by means of radioisotope scanning [12] through the use of the rectilinear scanner, the Anger gamma camera and the whole body profile scanner.

The scanner employed in this work was able to detect some abnormalities in the brain. More males than females present as brain patients. Most of the females that reported for brain scan were within their prime ages and could be suffering from problems that could not be shown on the scan. Most of them complained of headaches. Vascular lesion and meningioma formed the bulk constituting 5.7% and 4.1% respectively.

Most patients with liver problems present late in their illness and their defects were readily detected. Only 4 out of the 23 patients tested negative. At this stage the prognosis was very poor, most of them with positive tests arrived virtually weak on stretchers with distended stomach and few patients survived more than a few months after positive diagnosis. Cirrhosis and cancer/cyst formed 43.3% and 26.1% respectively. Isotopic liver scan provides a uniform picture and does

Accra. Owusu and Ocran [5] had 14 cases in 11 months in Accra.

The annual incidence of thyrotoxicosis varies from 22 per 100,000 in Denmark to 50 per 100,000 in West of Scotland, and in 12 British towns, 22.7 per 100,000 [17]. Comparing these values with 32 per 315 patients within 8 months, the incidence is quite high in Ghana.

CONCLUSION

The utilization of scanning agents for clinically viable diagnosis of the brain, liver and thyroid has been made possible by the production of modern radionuclides and imaging instruments

A total of 613 patients with complaints from brain, liver and thyroid were examined. About 16.3% of the brain patients were diagnosed abnormal of which female to male ratio was about 1:5. About 78.3% of the liver patients were diagnosed positive. Also about 56.5% of the thyroid patients were diagnosed positive. Of these goitre formed 75.0%, hyperthyroidism, 15.7% and hypothyroidism 18%. Other thyroid diseases diagnosed were graves, non-localized gland and neoplasm, cyst or cancer.

In view of the earlier reports concerning thyroid diseases in the African, these diseases are on the increase. These could be averted partly by education on iodine dietary.

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