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Cancer Screening by Computed Tomography Scanning in Sub-Saharan Africa: A Ghanaian Perspective.

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ABSTRACT

Early diagnosis and treatment is of utmost importance when cancer management is concerned, since a good prognosis usually correlates well with a smaller tumour stage. This study aimed to ascertain the commonest sites of tumour occurrence, and the smallest size at which tumours can be detected using computed tomography scanning, to aid in advocacy for its use in early tumour detection. A retrospective descriptive study was conducted using data extracted from request forms and corresponding radiological reports of 262 patients who presented for Computed Tomography (CT) scanning with a history indicative of a tumour at the Radiology Department of the Korle-Bu Teaching Hospital (KBTH) in January 2011. The request forms and their corresponding reports were obtained from the departmental archives. The Statistical Package for Social Sciences (SPSS) version 17 was used to analyse the data collected descriptively. Fifty-eight patients had focal tumours, 31 (53.4%) were males whiles 27 (46.6%) were females. The mean age and standard deviation of the 58 patients was 50.2 years ± 17.8. The smallest tumour size was less than 2cm and the largest was greater than 10cm. The three commonest tumour sites recorded in this study were the brain, kidney and liver in decreasing order of frequency. The study has given an indication of the smallest size and the three most common sites of tumour occurrence in the study population. In view of the high radiation burden from CT scanning, diagnosing tumours using ultrasound would be more appropriate, except in obese individuals where ultrasonographic visualisation is limited.

Keywords: Cancer Screening, Computed Tomography Scanning.

INTRODUCTION

In Ghana, patients seeking medical attention for cancer treatment often present with late stage disease when there is little hope for a cure [1]. Some of these patients spend almost all their resources and time travelling from one un-orthodox (shrines, herbal treatment centres, etc) medical practice to another,

before eventually settling for orthodox treatment[1]. Early diagnosis and treatment is of utmost importance in cancer management since a good prognosis usually correlates well with a smaller tumour stage. It is stated[2] that the tumour node and metastasis (TNM) classification used for staging tumours depends on size and the absence of spread of tumours cells beyond the confines of the primary tumour site.

Early detection of tumours is possible due to the availability of numerous medical imaging modalities. The most commonly used imaging modalities at the Korle-Bu Teaching Hospital (K.B.T.H.) in Ghana are plain radiography, barium studies, mammography and ultrasonography. In Nigeria it has been reported [3] that brain scans, electroencephalography and skull x-rays have been used as brain cancer detection tools.

Cancer screening is of particular importance for early tumour detection at sites which are not accessible by palpation, such as intracranial and intrathoracic locations. Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) are therefore very useful for the screening of brain and lung tumours [4]. However, to date, there is no effective screening test or guideline for brain and lung cancer worldwide [5, 6, 7].

Cancers of the respiratory system are commonly evaluated first with plain chest radiographs. Computed tomography however has a greater capability of detecting smaller masses in the hidden areas of the chest, often missed on plain radiographs. It has been suggested that improvements in CT technology is likely to make lung cancer screening feasible[8]. It has also been observed that CT scans detected more lung cancers at an earlier and more treatable stage, and could therefore reduce the number of deaths in patients at high risk of lung cancer[9,10]. However the use of CT scans for lung cancer screening requires further research and analysis[9].

The lung cancer incidence in Ghana stands at 3.1 per 100,000 as against 51.4 per 100,000 for Hungary and 19.6 per 100,000 for South Africa[11]. In Ghana, lung cancer is not included in the top four causes of cancer death in males and females[12]. The top four malignancies affecting adult females in descending order in Ghana were breast (17.2%), haematopoeitic organs (14.7%), liver (10.9%) and cervix (8.4%), whilst in men, the frequencies were liver (21.2%), prostate (17.4%), haematopoeitic organs (15.5%) and stomach

(7.3%)[12]. This means that screening the general population for lung cancer may be unwarranted due to the small incidence. Screening if considered should therefore be targeted at high risk groups.

CT scanning for intra-abdominal tumours is superseded by other imaging modalities such as barium sulfate or gastografin studies for gastrointestinal evaluation, and sonography and MRI for the solid organs[13]. This is due to its accompanying high ionizing radiation dose.

Sonography and MRI are not associated with ionizing radiation; however sonography is often limited by obesity which may prevent adequate evaluation of the posterior parts of the liver, the kidneys and spleen. Increased bowel gas shadowing often limits complete visualisation of the pancreas and retroperitoneal structures.[14] In Ghana, MRI is not readily available and is usually expensive even for patients who have genuine indications for its use. CT scanning however is not limited by the problems associated with sonography, and is also relatively cheap and quick, making it a more acceptable abdominal cancer screening method in obese individuals. Over the past decade, CT facilities have become readily available in Ghana and therefore could be used in cancer screening for early tumour detection. This study therefore seeks to ascertain the suitability of CT scanning as a tool for cancer screening to aid in advocacy for its use in early tumour detection.

MATERIALS AND METHODS

A retrospective descriptive study was conducted using data extracted from request forms and corresponding radiological reports of 262 patients who presented for computed tomography scanning with a history indicative of a tumour, at the Radiology department of the Korle-Bu Teaching Hospital in January 2011. The images were reviewed and reported by 5 Radiologists with more than 6 years post-qualification experience. The request forms and their corresponding reports were obtained from the departmental archives. The criteria for subject selection were based on the presence of one or more focal tumours visualised on CT images. The CT images were produced using a Philips dual Slice C.T. scan model Mx8000 Dual v EXP2.5. Information recorded on the reports included patient age, sex, number of masses, tumour site, size, type and evidence of metastases to the liver, lymph nodes

or skeleton. The statistical package for Social Sciences version 17 was used to analyse the data collected descriptively.

RESULTS

Demographic Data of Patients

Out of 262 images examined, 64 were diagnosed by CT Scanning to have tumours, of which 58 patients had images with focal tumours, and 6 had diffuse tumours which were immeasurable. Of the 58 patients with focal tumors, thirty-one (53.4%) were males whiles 27 (46.6%) were females. The mean age and standard deviation of the 58 patients diagnosed with focal tumours was 50.2 years ± 17.8. The minimum and maximum ages of the sample population were 3 and 82 years respectively.

Tumour Characteristics

Out of the 58 patient images examined, 56.9% of them had benign tumours and 43.1% were malignant tumours. Majority (56%) of the malignant tumours were recorded in females. The study indicated a bimodal distribution of tumour cases in the age groups of 41-50 years and 61-70 years. Table 1 shows the age group of patients, tumour type and Gender in cross tabulation.

Number of Tumour Masses and Sizes

Out of the 58 patients, 75.9% had single masses while 15.5% had 4 or more masses. Majority (46.6%) of the patients had tumour sizes ranging between 2-5cm. Figure 1 and Table 2 show the number of tumours per patient, and tumour sizes recorded respectively

Tumour Sites

The study indicated that the three commonest sites of tumour recorded in the study were brain, kidney and liver in descending order of frequency. The highest cases of benign tumours were recorded in the kidneys, whiles the brain had the highest number of malignant tumours. Table 3a shows Tumour sites and type in cross tabulation

Tumour Sizes

Tumours larger than 10cm were recorded in the liver, kidney, ovary, pancreas, thyroid and chest. The smallest size (<2cm) of tumours were recorded in the liver, kidney, thyroid and urinary bladder. Table 4 illustrates the range of tumour sizes in different organs

Tumour Metastases

There was evidence of possible tumour metastases to the liver and regional lymph nodes but not the skeleton. Table 5 illustrates the distribution of tumour metastases for the two genders.

DISCUSSION

There is very little statistical data on the frequency and management of

tumours in Ghana. A 10 year study conducted at the Pathology department of the Korle-Bu Teaching Hospital from 1991 to 2000 however provides valuable current data on the Ghanaian situation, despite the fact that the study was more of a hospital based one. The study revealed that the top 4 malignancies affecting adult females in descending order were breast (17.2%), haematopoeitic organs (14.7%), liver (10.9%) and cervix (8.4%), whilst in men, the frequency decreased from liver (21.2%), to prostate (17.4%), the haematopoeitic organs (15.5%) , and then the stomach (7.3%)[11]. It has been reported that malignant neoplasms accounted for 2.6% and 5.6% of all admissions and deaths respectively at the KBTH in the year 1996.[15]

The current study revealed that brain (19.0%), kidney (17.2%) and liver tumours (15.5%) were the commonest detected at the CT unit of the KBTH. Unfortunately, only liver tumours are among the top 4 commonest tumours in Ghana and hence, may be the only tumour to warrant the establishment of screening programs, especially with the increasing incidence of hepatitis B and its complication of liver cancer in Ghana.[16, 17] This study also reveals that about half of the liver tumours had malignant features, with a male to female ratio of about 3:1. There may therefore be a case for radiological liver cancer screening, especially of males who seem to be at a higher risk.

The tumour sizes recorded in this study ranged from less than 2cm for 3 benign lesions and 1 malignant lesion, to over 10cm for 8 and 5 benign and malignant lesions respectively. This means it is possible to detect stage one tumours by CT screening which is likely to result in increased survival rates after treatment. There were 6 and 5 suspected cases of liver and adjacent lymph node metastases respectively. Unlike in a Japanese study where the growth rate of liver tumours was 0.59cm3/day [18], local figures regarding the growth rate of intra-abdominal and intracranial malignancies are not readily available for comparison, hence the benignity or otherwise of tumours in the Ghanaian setting cannot be determined based on their size only.

This study also shows that the 1-10 and 61 – 80 year age groups had smaller tumours, possibly due to their smaller stature or thinner abdominal tissues (except in obese patients). Patients aged 11 to 60 and 81 to 90 years showed larger tumours. This may be due to late

presentation to hospital for reasons such as fear of having to undergo an operation, cost of hospital management, neglect and lack of information.[1]

Currently in Ghana, sonography is the commonest alternative imaging modality to computed tomography. It is readily available in all ten regions of Ghana and affordable for most people. There are however very few qualified operators well-versed in abdominal imaging, as most service providers are more comfortable with antenatal scanning. Evaluations other than for pregnancies are therefore usually done by radiologists who in 2010 numbered about 25,[19]and a few well-trained doctors and radiographers. Conventional radiography is also readily available, but is inferior to CT due to the superimposition of tissues, and the inability to distinguish between solid and fluid containing tissues based on the degree of tissue opacification [20]. MRI facilities are few in Ghana and are only found in 3 of 10 regions. Furthermore, the cost of an MRI examination in Ghana is too expensive for the average person, being about 2 to 3 times that of a CT scan. On the other hand, CT scans are currently available in many regional capitals in Ghana, and with its merit over sonography in terms of operator independency, it could be considered as a better option for at least two of the common tumours in both sexes (tumours of the liver and haematopoeitic organs). Screening with CT scanning is therefore likely to be advantageous in obese individuals where sonography usually gives limited results [21]. CT scanning often requires the use of contrast media which may rarely cause contrast reactions. Less than 3 fatalities have been recorded in the last 15 years at the KBTH. These reactions are more likely to occur in asthmatics, people with unstable medical conditions and in those with a history of allergies or previous contrast reactions. The introduction of low-osmolality agents has caused an overall reduction in the number of fatal and non-fatal contrast reactions [22].

The use of ionizing radiation in Ghana is generally guided by the radiation protection and safety regulations for diagnostic imaging in Ghana which is published in the Radiation Protection and Safety Guide (2003) [23] supported by the Ghana Atomic Energy Act 204 (1993). It covers a range of subjects consistent with recommendations of ICRP Publication 60 (1991) [24] and IAEA Basic Safety Standards (2002) [25]. With the formation of the Ghana Association of Radiologists and Ghana Society of Radiographers, it is envisaged that these groups will partner the Ghana Medical Council in the formulation of

health related policies requiring the use of ionizing radiation.

CONCLUSION

C.T. scanning is a very effective way for both detecting and staging tumours. It however involves the use of ionizing radiation and therefore should be used as a screening tool only when absolutely necessary. The availability of alternative imaging modalities which do not use ionizing radiation have superseded C.T. scanning as a primary modality for tumour screening in Ghana. The study has also given an indication of the smallest size and the three most common sites of tumour occurrence in the study population. The relatively high body surface dose per C.T. scan examination and low incidence in the population of brain and lung tumours do not favour the use of C.T. scanning as a screening tool in Ghana. In future however, C.T. scanning may become a useful screening tool in Ghana to detect liver and renal cancers in obese patients where sonographic image quality is often poor. The non availability and high cost of magnetic resonance imaging equipment make them an unsuitable alternative screening tool in Ghana.

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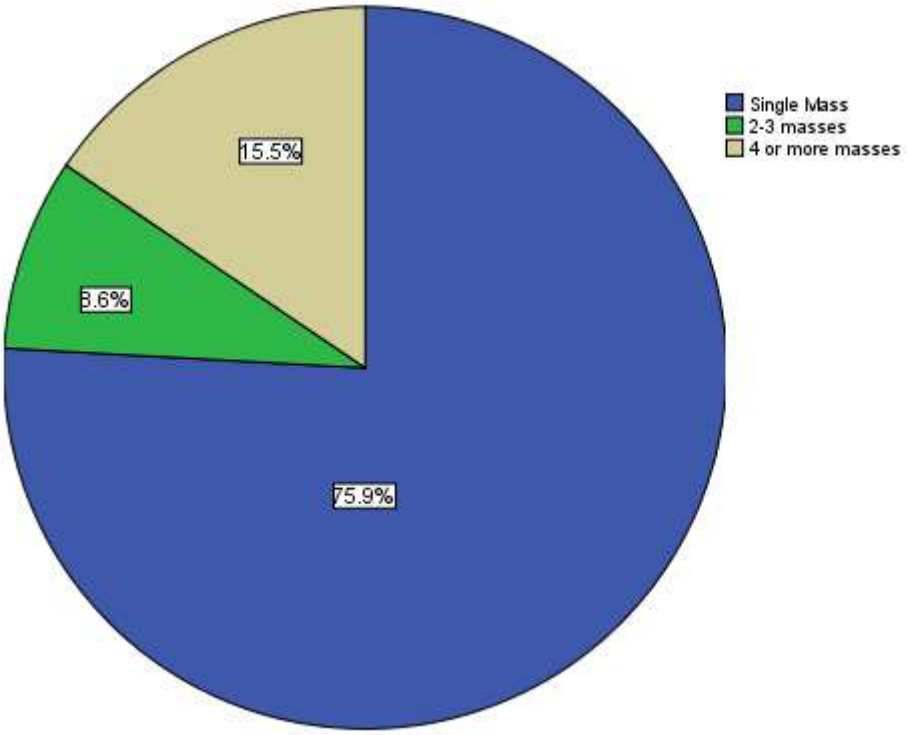

Figure 1: Number of Tumours Per Patient

Table 1: Age Group of Patients, Tumour Type, and Gender of Patients in Cross Tabulation

Gender of Patients /Age Group (Years)		Tumour Type		Total
		Benign	Malignant	
Male	1-10	1	0	1
	21-30	1	2	3
	31-40	4	0	4
	41-50	4	3	7
	51-60	3	2	5
	61-70	4	3	7
	71-80	2	1	3
	81-90	1	0	1
	Total	20	11	31
Female	1-10	1	0	1
	11-20	1	0	1
	21-30	1	1	2
	31-40	0	3	3
	41-50	1	5	6
	51-60	5	0	5
	61-70	3	3	6
	71-80	1	2	3
	Total	**13**	**14**	**27**

Table 2: Tumour Sizes Recorded

Tumour Size	Frequency	Percent
< 2 cm	4	6.9
2-5 cm	27	46.6
6-10 cm	14	24.1
> 10 cm	13	22.4
Total	**58**	**100.0**

Table 3a: Tumour Sites and Type in Cross Tabulation

Tumour Site	Tumour Type		Total
	Benign	Malignant	
Brain	6	5	11
Spleen	0	1	1
Liver	5	4	9
Kidney	8	2	10
Prostate	0	1	1
Ovarian	0	2	2
Oral	2	2	4
Pancreas	2	0	2
Thyroid	5	2	7
Bone	0	2	2
Chest	3	2	5
Urinary bladder	0	2	2
Mysentry	1	0	1
Nose	1	0	1
Total	**33**	**25**	**58**

Table 3b: Gender, Tumour Sites and Type in Cross Tabulation

Gender / Tumour site		Tumour Type		Total
		Benign	Malignant	
Male	Brain	6	1	7
	Liver	4	3	7
	Renal	3	1	4
	Prostate	0	1	1
	Oral	2	2	4
	Pancreas	1	0	1
	Tyroid/Neck	3	1	4
	Chest	1	1	2
	Urinary bladder	0	1	1
	Total	**20**	**11**	**31**
Female	Brain	0	4	4
	Spleen	0	1	1
	Liver	1	1	2
	Renal	5	1	6
	Ovarian	0	2	2
	Pancreas	1	0	1
	Tyroid/Neck	2	1	3
	Bone	0	2	2
	Chest	2	1	3
	Urinary bladder	0	1	1
	Mysentry	1	0	1
	Nose	1	0	1
	Total	**13**	**14**	**27**

Table 4: Range of Tumour Sizes in Different Organs

Organ	Minimum Size/cm	Maximum Size/cm
Brain	2	10
Spleen	2	5
Liver	< 2	> 10
Kidney	< 2	>10
Prostate	2	5
Ovarian	-	>10
Ear, nose and throat	2	10
Pancreas	-	>10
Thyroid	< 2	>10
Bone	2	10
Chest	2	>10
Urinary bladder	< 2	10
Mesentery	2	5

Table 5: Metastatic Lesions and Gender Distribution in Cross-Tabulation

	Metastatic Lesions	
Gender	**Liver**	**Lymph Node**
Male	3	3
Female	3	2
Total	**6**	**5**

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