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Pattern of chest X-ray findings among adult hypertensive patients at the radiology department of Nnamdi Azikiwe University teaching hospital Nnewi, Anambra state

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Keywords

Chest X-ray findings, Hypertensive patients, Radiology Department, Nnamdi Azikiwe University Teaching Hospital Nnewi.

Abstract

Hypertension is a major health problem throughout the world because of its high prevalence and its association with increased risk of cardiovascular disease, its incidence in the middle aged and adult population is fast increasing due to obesity, physical inactivity and increased salt intake. Although hypertension has been defined to be a sustained elevation of systemic arterial blood pressure to a level that can induce cardiovascular damages and other adverse consequences, it has evolved into a progressive cardiovascular syndrome with many causes that result in both functional and structural changes to the heart and vascular system. These changes can be made visible using radiological modalities such as plain x-ray, MRI, CT, Echocardiography etc., and appropriate diagnosis made from the findings obtained.This study is aimed at determining whether or not there are findings, revealing the pattern of such findings, establishing the percentage prevalence of the findings, establishing a relationship between sex and the pattern of the findings and to reveal the age range with the highest prevalence of findings in middle aged and adult population using plain chest x-rays.A convenience sampling technique was used to obtain a sample size of 200, consisting of 54(27.0%) males and 146(73.0%) females, with ages ranging from 18 – 85 years.The result of this study showed that there were abnormal findings such as aortic unfolding, heart failure, left ventricular preponderance, cardiomegaly, presence of atheromatous plague in the aortic knuckle and calcification in the aortic arch, of which aortic unfolding was seen to be the most prevalent; that the female presented more with symptoms of hypertension (146(73.0%)) as well as displayed the highest frequency and percentage of findings (62(69.66%)); and that those aged 70 years and above had the highest prevalence with frequency and percentage of 71 and 35.5%.The result of this study showed that there were findings in the plain chest x-rays of hypertensive patients, and there is a relationship between sex, age and pattern of findings.

Introduction

Blood pressure (BP) is the force of blood against the walls of the artery as it circulates throughout the body, the magnitude of this force depends on the cardiac output and the resistance of the blood vessels (Markus, 2016). Blood pressure is expressed by two measurements, the systolic and diastolic pressures, which are the maximum and minimum pressures respectively in the arterial system. It is measured with a device called a sphygmomanometer (McArdle *et al.*,

2001). The systolic pressure occurs when the left ventricle is mostly contracted and the diastolic pressure occurs when the left ventricle is mostly relaxed prior to the next contraction. Normal blood pressure at rest is within the range of 100–140 millimetres mercury (mmHg) systolic and 60–90 mmHg diastolic (Rafey, 2013).

The blood pressure normally rises and falls throughout the day, but it can only cause health problems if it stays high for a long time. Because there is a continuous, consistent, and independent relationship between elevated blood pressure and risk of cardiovascular events, normal blood pressure has been defined by many authors as systolic blood pressure of ≤120mmHg and diastolic blood pressure of ≤80mmHg (Brady, 2005).Prehypertension is a medical classification for cases where a person's blood pressure is elevated above normal, but not to the level considered hypertension. Therefore readings greater than or equal to 140/90mmHg may be considered hypertension (systemic hypertension in particular, as there are other types of hypertension such as pulmonary hypertension for resting mean pulmonary arterial pressure of 25 mmHg or greater at right heart catheterisation and portal hypertension for portal venous pressure greater than 12 mmHg), that is to say that hypertension is a condition characterised by an abnormally high arterial blood pressure. Hypertension is classified as either primary (essential) hypertension or secondary hypertension (Addo, 2007).

An increased rate of high blood urea has been found in untreated people with hypertension in comparison with people with normal blood pressure, although it is uncertain whether the former plays a causal role or is subsidiary to poor kidney function (Gois *et al.*, 2013). Hypertension is rarely accompanied by any physical symptom, and its identification is usually through screening (such as that undertaken in the radiology departments), or when seeking healthcare for an unrelated problem; some with high blood pressure report headaches (particularly at the back of the head and in the morning), as well as light headedness, vertigo, tinnitus (buzzing or hissing in the ears), altered vision or fainting episodes (Williams *et al.*, 2005).

Several methods of diagnosing hypertension have evolved over time, ranging from the use of sphygmomanometer, which involves applying an inflatable cuff to the upper arm and determining the blood pressure level (Markus, 2016)

In this locality under study, pattern of chest x-ray findings among middle aged and adult hypertensive patients has not been documented to the best of the researcher's knowledge. Therefore there is the need to know if there are abnormal findings on plain chest x-ray images of hypertensive patients, the pattern of such findings and the prevalence of the common/abnormal findings in the locality. The study will be carried out in the radiology department of Nnamdi Azikiwe University Teaching Hospital, Nnewi, Anambra state.

Objectives

- To know if there are abnormal findings on plain chest x-ray images of hypertensive patients visiting radiology department of NnamdiAzikiwe University Teaching Hospital, Nnewi, and the pattern of such findings.
- To establish the percentage of prevalence of the common/abnormal findings visible on the plain x-ray image of hypertensive patients presenting to the department.
- To establish a relationship between sex and pattern of findings on plain chest x-ray of hypertensive patients who presented to the department.
- To know the age range with the highest prevalence of findings

Research Methodology

Research design

This research is a retrospective study of the pattern of chest x-ray findings among adult hypertensive patients at the radiology department of Nnamdi Azikiwe university teaching hospital (NAUTH), Nnewi, in Anambra state. Records of patients from June, 2012 to June, 2016, shall be used for this study.

Study population

This study is on adult patients whose request, query or referral documents are designatedhypertension, congestive cardiac failure or heart failure, by referring physician when presenting to the Radiology department of NnamdiAzikiwe university teaching hospital, Nnewi.

Sample size

A convenience sampling technique was adopted, to obtain a sample size of 200 for this study.

Equipments / Materials

Chest radiographs obtained through standard radiographic procedures and adequate exposure factors, archives of patients' records as well as Radiologists' report for each investigation shall be used for this study, to obtain the appropriate required data.

Procedure for data collection

Data will be collected from request, query or referral documents in the x-ray unit including the reports. The following information will be collected from the patients' x-ray jackets and request, query or referral documents.

- Date of Examination
- Patient x-ray number
- Patient age
- Sex
- Clinical indication
- Radiologist's final report
- Modality used

Data analysis

Data was analysed using statistical package for social science, SPSS (version 20) based on findings, prevalence, sex and age. Results will be presented on frequency and percentage table.

Data presentation and analysis

Table 1: shows prevalence of normal and abnormal Findings on chest x- ray images of hospital patients visiting radiology department.

FINDINGS	Prevalence	Percentage
AORTIC UNFOLDING	37	18.5
CARDIOMEGALY	12	6.0
HEART FAILURE	23	11.5
LEFT VENTRICULAR PREPONDERANCE	13	6.5
NORMAL	111	55.5
PRESENCE OF ATHEROMATOUS PLAGUE IN THE AORTIC KNUCKLE	2	1.0
CALCIFICATION OF THE ARCH	2	1.0
Total	200	100.0

Table 1 shows the Findings of the hospital patients visiting radiology department for plain chest x-ray, the result of the findings revealed that the majority of the patients were found to be normal with the prevalence of 111(55.5%), followed with that of aortic unfolding with 37 (18.5%) while that of heart failure was 23(11.5%).

However, the findings also showed that left ventricular preponderance,cardiomegaly, were 13(6.5%) and 12(6%) respectively while presence of atheromatous plague in the aortic knuckle 2(1%) and calcification of the arch 2(1%) were the least findings of the clinical indication.

Moreover, comparing the normal and abnormal findings of patient visiting radiology department for plain chest x-ray revealed that there was significance ($p<0.05$) at 95% level of confidence.

Table 2: Sex of the hospital patient visiting radiology department for chest x-ray

SEX	Frequency	Percent
MALES	54	27.0
FEMALES	146	73.0
Total	200	100.0

Table 2 shows the sex of the hospital patient visiting radiology department for chest x-ray, the table revealed that more women visit radiology department for plain chest x-ray with frequency of 146(73%) and less males with a frequency of 54(27%).

Table 4.3: showing the percentage prevalence relationship between sex and x-ray finding of hospital patient visiting radiology department for chest x-ray

FINDINGS	SEX		Total
	MALES	FEMALES	
Aortic unfolding	10(11.24%)	27(30.34%)	37(41.57%)
Cardiomegaly	6(6.74%)	6(6.74%)	12(13.48%)
Heart failure	6(6.74%)	17(19.10%)	23(25.84%)
Left ventricular preponderance	3(3.37%)	10(11.24%)	13(14.61%)
Presence of atheromatous plague in the aortic knuckle	1(1.12%)	1(1.12%)	2(2.25%)
Calcification of the arch	1(1.12%)	1(1.12%)	2(2.25%)
Total	27(30.34%)	62(69.66%)	89(100%)

Table 3 revealed the relationship between sex and x-ray findings of hospital patients visiting radiology department for chest x-ray.

The result showed that the findings for female subjects were the highest with 62(69.66%) and 27(30.34%) for the males subjects. Aortic unfolding had the highest frequency 37(41.57%) abnormal cardiac findings among the males with 10(11.24%) and females subjects with 27(30.34%) cases. This followed by heart failure with 23(25.84%) findings with females having the highest frequency of 17(19.10%) and males 6(6.74%). The averagely found cases were left ventricular preponderance with the frequency of 13(14.61%) with females dominant with the frequency of 10(11.24%) and males with 3(3.37%), also averagely found was cardiomegaly with the frequency of 12 (13.48%), with the frequency of 6(6.74%) for males and females respectively. The least findings revealed presence of atheromatous plague in the aortic knuckle and Calcification of the arch 2(2.25%) with one case in both males and females respectively.

Table 4: Ages of the hospital patient visiting radiology department for chest x-ray

AGE RANGE (years)	Frequency	Percentage
(<20-30)	4	2.0
(31-40)	13	6.5
(41-50)	20	10.0
(51-60)	39	19.5
(61-70)	53	26.5
(>70)	71	35.5
Total	200	100.0

Table 4.4 shows the ages of the hospital patients visiting radiology department for chest x-ray, the table revealed that the people visiting for plain chest x-ray was between the age ranges of (18 – 85) years with the mean age of (62.3±14.60) years. Elderly people were the most frequently visitors, the age ranges greater than 70 years were 71(35.5%) with the highest, followed by those between (61-70) years were 53 (26.5%) while those between (51-60) years age ranges were 39 (19.5%). However, people with the age ranges between (41-50) years were few with only 20(10.0%) respondents, while those between (31-40) years were 13(6.5%) and (<20-30) years were 4(2.0%) respectively.

Table 5: Distribution of x-ray findings according to age

FINDINGS	AGE (<20-30)	(31-40)	(41-50)	(51-60)	(>70)	Total
AORTIC UNFOLDING	4(4.5)	13(14.6)	0	3(3.4)	17(19.1)	37(41.6)
CARDIOMEGALY	0	0	10(11.2)	2(2.2)	0	12(13.5)
HEART FAILURE	0	0	10(11.2)	2(2.2)	11(12.4)	23(25.8)
LEFT VENTRICULAR PREPONDERANCE	0	0	0	9(10.1)	4(4.5)	13(14.6)
PRESENCE OF ARTEROMATOUS PLAGUE IN THE AORTIC KNUCKLE	0	0	0	2	0	2(2.2)
CALCIFICATION OF THE ARCH	00		0	2	0	2(2.2)
Total	4(4.5)	13(14.6)	20(22.5)	20(22.5)	32.0(36.0)	89(100.0)

Table 5 reveals the percentage prevalence of relationship between age range and x-ray finding of hospital patients visiting radiology department for chest x-ray.

The result showed that the age ranges of 70 years and above had the highest frequency of 32(36.0%), with the dominant case of aortic unfolding 17(19.1), heart failure 11(12.4), and left ventricular preponderance 4(4.5). Followed by the age ranges of (41-50) years with the frequency of 20(22.5%) with Cardiomegaly 10(11.2) and heart failure 10(11.2) being the predominant findings found within this age range. In the age ranges of (51-60) years, left ventricular preponderance was the predominant findings with the frequency of 9(10.1%), the frequency foraortic unfolding was 3(3.4), that for cardiomegaly was 2(2.2) and for heart failure frequency 2(2.2).

The Age ranges of (31-40) and (<20-30) had the least cases with the frequencies of 13(14.6%) and 4(4.5%) respectively.

Discussion

The study "pattern of chest x-ray findings among adult hypertensive patients at the radiology department of Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi", was due to the researcher's interest in human cardiovascular system radiology, and to determine whether pathologies of the cardiac system which are often signs of hypertension are found in the x-ray images produced of the patients who presents to the radiology department of Nnamdi Azikiwe University Teaching Hospital (NAUTH) for chest x-ray examination with indication of hypertension or cardiac failure, and if so, what pattern? This was necessary although not primarily because the benefit of patient's exposure to radiation must outweigh the risks, according to the 'justification and optimization' principle of radiation protection (Malone *et al.*, 2012), in an incidence of normal finding in the image it can be felt that both money and time is wasted. This is backed by the fact that some of the patients who presented with symptoms were diagnosed normal. Following the principle of justification and optimization, if the patients were normal it would have been unnecessary to expose them to x-ray even though this provides enough reason to question the sensitivity and specificity of plain x-ray towards diagnosing hypertension. However, findings or diagnosis can only be obtained when patients who present with symptoms are examined.

The result of the study showed that although there were pathological findings in the images of some of the patients who presented for chest x-ray, there were more of the patients with normal findings (55.5%), as against those with pathological findings (44.5%). Of this value, aortic unfolding, heart failure, left ventricular preponderance, cardiomegaly, presence of atheromatous plague in the aortic knuckle and calcification of the arch which were the clinical or pathological findings in the report, showed 18.5, 11.5, 6.5, 6.0, 1.0 and 1.0 percentages of prevalence respectively. Aortic unfolding was the most prevalent of all the pathological findings; this is in line with report of Lee *et al*. (2014).

The result of this study also showed that data for both sexes (i.e. male and female) were obtained and analyzed. Of the two hundred sets of data collected, there were fifty-four males and a hundred and forty-six females. This showed that more females visited the radiology department during the period of this study as against males, with a frequency and percentage of 146(73%) and 54(27%) respectively.

The study further revealed that among all the clinical findings, aortic unfolding, heart failure, left ventricular preponderance and cardiomegaly were the most prevalent, with aortic unfolding displaying the highest frequency. The females were also seen to display the highest total frequency and percentage (62(69.66%)) of the primary findings which were contributed primarily by aortic unfolding, heart failure and left ventricular preponderance, as against the males (27(30.34%)). The reason for the high incidence and prevalence in females is said to be unknown, however this may not be unconnected to hormonal factor and high salt intake (Landahl *et al.,* 2016).

Furthermore, the result showed that the data obtained were of patients with ages ranging from 18 to 85 years with a mean age of 62.3±14.60 years. It was shown that patients aged 70 years and above visited the radiology department for chest x-ray querying hypertension more than other groups, with a frequency and percentage of 71(35.5%), while those between (61-70) years were 53 (26.5%), and those with the least were those of the age range of less than 20 and 30 years with 4(2.0%). This result showed that the incidence and prevalence of hypertension increases with age, as supported by the study done by (Landahl *et al.*, in 2016).

Conclusion

Although plain x-ray cannot be described to be an excellent tool for diagnosing hypertension, it revealed a considerable level of abnormal findings that helped in establishing the relative level of prevalence, establishing a relationship between sex and pattern of findings as well as the age range with the highest incidence of hypertension. Therefore plain chest radiograph can be used where there are no other imaging modalities with higher sensitivity and specificity for picking slight pathological signs of hypertension and where a patient cannot afford for the use of other modalities such as echocardiogram, computed tomography and magnetic resonance imaging.

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