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THREE-YEAR REVIEW**

INDICATION FOR SPIROMETRY AND PATTERN OF LUNG FUNCTIONS AMONG PATIENTS IN A TERTIARY HEALTH INSTITUTION IN NORTHWEST NIGERIA: A THREE-YEAR REVIEW

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ABSTRACT

Introduction: This study aimed to assess the indications for spirometry and lung function patterns among patients attending a tertiary health institution in Northwestern Nigeria.

Methods: The study involved a total of 238 patients who had spirometry done between 2018 and 2020 at the Federal Teaching Hospital Katsina. Patient records, including age, gender, height, weight, BMI, indication for spirometry, and spirometry parameters, were extracted from the unit register. All spirometry tests were conducted using a standard field spirometer. Data were analyzed using SPSS version 21.

Results: Restrictive pattern of lung function was found in 29.8% of the total patients reviewed while the obstructive pattern accounted for 15.1% and only 4.6% had a mixed pattern of lung function. The commonest indication for spirometry recorded was asthma (37%) while COPD accounted for 17.6% in the reviewed years.

Conclusion: Asthma, medical check-ups, and COPD were the common indications for spirometry, and restrictive lung function was

the predominant pattern observed among patients.

Keywords: Spirometry, pattern, review, Northwest Nigeria.

INTRODUCTION

Respiratory diseases are the leading cause of mortality and morbidity worldwide.¹ About 65 million people suffer from chronic obstructive pulmonary disease (COPD).¹ Asthma currently affects an estimated 300 million people worldwide and is projected to increase to 400 million by the year 2025.²

The respiratory tract can be anatomically divided into lower and upper airways.³ Key important functions of the airway include the exchange of gas and ventilation, but this is sometimes limited by pathological processes.⁴ A spirometry evaluation could be used to identify an individual's level of breathing difficulty. Spirometry is a physiological test that measures how an individual inhales or exhales a volume of air as a function of time.⁵ It is crucial in the diagnosis, differentiation, and management

of respiratory illnesses such as COPD, asthma, and restrictive lung disorders.⁵ It is also essential to evaluate lung health and assess risk in people exposed to occupational and environmental hazards prior to surgery.^{6,7}

Spirometry aids in categorizing the ventilatory function into four categories: normal, obstructive, restrictive, and mixed patterns. A number of studies have found that obstructive lung diseases, such as asthma and COPD, are the most common reasons for spirometry in Nigeria.^{8,9} However, no study has been carried out among the general population in Katsina State, Nigeria. This study aims to assess the indications for spirometry and ventilatory patterns among patients attending the lung unit at the Federal Medical Centre, Katsina, Nigeria.

METHODS

Study area

The study was carried out at the lung unit of the Federal Teaching Hospital Katsina. It involved a retrospective review of patients' records that had spirometry during the course of evaluation for respiratory diseases.

Study design

The study was a retrospective descriptive design

Duration of review

The study involved a data review between 2018 and 2020.

Technique

Data were retrieved via electronic health records and information extracted included patients' biodata, anthropometric details, spirometry, and ventilatory measurements. All patients with spirometry tracings that met

the acceptability and reproducibility criteria were recruited, and those with poor tracings and ages less than 18 years were excluded. All spirometry tests were conducted using a standard field spirometer, the Schiller Spirovit SP-1 2014 model (Serial No. 540-13824) made by Medical Device Depot in Switzerland. The procedure was conducted and the result was interpreted in accordance with the standardization requirements of the American Thoracic Society (ATS) by a medical unit technologist and a consultant pulmonologist.

The findings of spirometry were classified as normal pattern (FEV1/FVC >70%; FVC >80% of predicted), obstructive pattern (FEV1/FVC <70% & FEV1 <80% of predicted), restrictive pattern (FEV1/FVC >70% & FVC <80% of predicted) and mixed pattern (FEV1/FVC <70% & FVC <80% predicted) in line with the current ERS/ATS guidelines.¹⁰⁻¹²

The Statistical Package for Social Sciences (SPSS) version 21 was used to analyze the data. Qualitative variables such as sociodemographic data and spirometry patterns were analyzed and means of quantitative variables were found. Associations between variables were explored using the chi-square test of independence. A p-value of 0.05 was considered significant.

Ethical Approval

Ethical clearances were obtained from the ethical review committee of the Federal Teaching Hospital, Katsina, Katsina State.

RESULTS

A total of 238 patients had spirometry done between January 2018 and December 2020. In 2018, 35.5% of all procedures were

performed, 61.8% in 2019, and 23.5% in 2020.

Table 1 depicts the lung function patterns across the demographic profile and anthropometric characteristics of patients studied. One hundred and twenty-eight patients (53.8%) were males, and one hundred and ten patients (46.2%) were females. Patients ranged in age from 18 to 86 years, with the majority being between the ages of 30 and 49 years, with a mean age of 40.4 ± 17.0 years. Thirty-six (15.1%) of the patients were underweight, 26.1% were overweight, and 14.3% were obese.

Table 1: Demographic profile and body mass index of patients

Variables	Frequency	Percentage (%)
Gender		
Male	128	53.8
Female	110	46.2
Age (years)		
< 29	77	32.4
30 – 49	94	39.5
50 – 69	50	21.0
70 years and above	17	7.1
BMI (kg/m²)		
Underweight	36	15.1
Normal	106	44.5
Overweight	62	26.1
Obese	34	14.3

Table 2: Spirometry pattern by demographics and body mass index of patients

Variables	n (%)				χ^2 (p-value)
	Normal	Restrictive	Obstructive	Mixed	
Gender					
Male	69 (57.5)	33 (46.5)	20 (55.6)	6 (54.5)	2.239 (0.524)
Female	51 (42.5)	38 (53.5)	16 (44.4)	5 (45.5)	
Age (years)					
< 29	45 (37.5)	23 (32.4)	5 (13.9)	4 (36.4)	60.630 (*0.0001)
30 – 49	58 (48.3)	30 (42.3)	3 (8.3)	3 (27.3)	
50 – 69	13 (10.8)	14 (19.7)	19 (52.8)	4 (36.4)	
70 years and above	4 (3.3)	4 (5.6)	9 (25.0)	0 (0.0)	
BMI (kg/m²)					
Underweight	15 (12.5)	7 (9.9)	13 (36.1)	1 (9.1)	32.977 (*0.0001)
Normal	60 (50.0)	26 (36.6)	17 (47.2)	3 (27.3)	
Overweight	32 (26.7)	19 (26.8)	5 (13.9)	6 (54.5)	
Obese	13 (10.8)	19 (26.8)	1 (2.8)	1 (9.1)	
Total	120 (50.4)	71 (29.8)	36 (15.1)	11 (4.6)	

* χ^2 : Chi square statistic, p-value < 0.05 indicates significance

Assessment of ventilatory function showed a normal pattern in half (50.4%) of the patients. A restrictive pattern was seen in 29.8% while 15.1% had an obstructive pattern and 4.6% had a mixed pattern. The gender of the patients had no effect on their

spirometry patterns; p-value = 0.524. There was a significant association between the age of patients and spirometry patterns; $\chi^2 = 60.630$, p-value = 0.0001. The proportion of patients with restrictive lung patterns was higher in the younger age groups (<29 years;

Table 3: Indications for spirometry

Indication	Frequency (percentage)			Total
	2018	2019	2020	
Asthma	14 (40)	46 (31.3)	28 (50.0)	88 (37%)
Medical check-up	0 (0.0)	53 (36.1)	0 (0.0)	53 (22.3)
COPD	12 (34.3)	19 (12.9)	11 (19.6)	42 (17.6)
Heart failure	2 (5.7)	4 (2.7)	5 (8.9)	11 (4.6)
Pulmonary fibrosis	2 (5.7)	4 (2.7)	3 (5.4)	9 (3.8)
Chronic cough	1 (2.9)	2 (1.4)	4 (7.1)	7 (2.9)
Asbestosis	0 (0.0)	7 (4.8)	0 (0.0)	7 (2.9)
Preoperative	1 (2.9)	4 (2.7)	1 (1.8)	3 (1.3)
Systemic sclerosis	1 (2.9)	2 (2.7)	3 (5.4)	3 (1.3)
Chest pain	0 (0.0)	0 (0.0)	1 (1.8)	1 (0.4)
Difficulty breathing	1 (2.9)	0 (0.0)	0 (0.0)	1 (0.4)
Dyspnea	0 (0.0)	0 (0.0)	1 (1.8)	1 (0.4)
Not documented	1 (2.9)	6 (4.1)	2 (3.6)	9 (3.8)
Total	35 (14.7)	147 (61.8)	56 (23.5)	

32.4%, 30 – 49 years; 42.3%, 50 – 69 years; 19.7%, 70 years and above; 5.6%), while the majority of patients with obstructive lung patterns were older (<29 years; 13.9%, 30 – 49 years; 8.3%, 50 – 69 years; 52.8%, 70 years and above; 25.0%). Of patients who are overweight or obese, restrictive lung function was higher (overweight; 26.8%, obese; 26.8%) compared to those with obstructive lung function (overweight; 13.9%, obese; 2.8%) (Table 2).

The predominant indication for spirometry in the patients was asthma (37%), followed by medical check-ups (22.3%), COPD (17.6%), heart failure (4.6%) and pulmonary fibrosis (3.8%) (Table 3).

The majority of the patients were referred from the medical unit of the hospital (154, 64.7%), followed by physicians from the family medicine department (63, 26.5%), while 12 (5.0%) were referred by the surgeons and 9 (3.8%) by other physicians (table 4).

DISCUSSION

There is an enormous burden of respiratory diseases worldwide, especially in Africa, Nigeria inclusive¹. Diagnosis of many of these is hampered because of poverty and a lack of good health facilities. Spirometry is a non-invasive tool of importance in the evaluation of the ventilatory function of the lung, which is crucial in the diagnosis, differentiation, and management of respiratory illnesses such as bronchial asthma, COPD, interstitial lung diseases, etc. It is a simple timed measurement of dynamic lung volumes and capacities during forced expiration and inspiration to quantify how effectively and quickly the lungs can be emptied and filled.^{4,5}

Table 4: Sources of referral for spirometry at FMC Katsina

Category	N (%)
Medical unit	154 (64.7)
Family medicine/NHIS	63 (26.5)
Surgeons	12 (5.0)
Not indicated	9 (3.8)

A total of two hundred and thirty-eight spirometry tests were carried out between 2018 and 2020. Although there was a steady increase from inception in 2018 to 2019, the interruption of clinical duties due to the COVID-19 pandemic led to a gross reduction noted in 2020. This study showed a slightly male preponderance (53.8% vs. 46.2%) and the majority of the participants were within the age range of 30–49 years. These findings were in accordance with various studies done within and outside the country.^{6,8,9,13,14} This might be due to the preponderance of the working population being exposed to various insults that might predispose them to respiratory illness, but contrary to the findings in a Canadian study where the majority of patients that underwent spirometry were elderly.¹⁵

The major lung function abnormality in this study was restrictive abnormality, which was followed by obstructive, and a mixed pattern was seen in 4.6%. This is similar to the findings of Desalu et al but differs from those of Jumbo et al who found that the obstructive pattern is the most predominant abnormality in spirometry requests in the south-south part of the country.^{6,13} The study showed a significant association between patients' age (years) and spirometry patterns, $\chi^2 = 60.630$, $p\text{-value} = 0.0001$. Patients in the younger age groups were more likely to have restrictive lung disease, whereas patients in the older age groups were more likely to have obstructive lung disease. This finding was similar to a study done by Jumbo in NDUTH where obstructive diseases are seen in an older population.¹³

Besides check-up purposes, bronchitis and COPD were the major pathological indications for spirometry in the review years. However, in a study done in Nepal, the majority of the spirometry done was due to COPD.¹⁶ Requests for spirometry are still low in this part of the country because of a lack of knowledge, awareness, and skills in interpreting the results of lung function tests, even if they are done by other health facilities.

CONCLUSION

From this report, Asthma, medical check-ups and COPD were the common indications for spirometry, and restrictive lung function was the predominant pattern seen among patients.

The role of spirometry in the assessment of lung function cannot be overemphasized, and its use by other physicians, especially in surgical areas should be encouraged.

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