Annals of African Medicine Vol. 9, No. 3; 2010:147-51
DOI: 10.4103/1596-3519.68365

Original Article

An audit of spirometry at the University of Ilorin Teaching Hospital, Ilorin, Nigeria (2002–2009)

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Abstract

Background: Spirometry is a noninvasive and cost-effective physiologic test that greatly complements other investigative procedures in evaluation of respiratory conditions. This study was aimed at auditing the spirometry performed at the University of Ilorin Teaching Hospital (UITH) Ilorin, Nigeria, and highlighting some of the challenges associated with the procedure.
Methods: We reviewed and analyzed the record of spirometry performed at the cardiopulmonary unit of the hospital from June 2002 to December 2009.
Results: A total of 119 patients had spirometry tests from 2002 to 2009 and their age ranged from 15 to 85 years with a mean of 47.6 ± 14.8 years. There were 69 (58%) males and the male:female ratio was 1.4:1. More than half (65%) of the tests were in patients <50 years old. The rate of spirometry performed annually increased from 12 (10.1%) in 2002 to 31 (26.1%) in year 2009. Evaluation of bronchial asthma was the most common indication for spirometry (43 patients; 36.1%). Majority of the requests (84 patients; 70.6%) were from adult respiratory physicians. The identified challenges were lack of awareness of the range of diseases that could be investigated by spirometry, lack of skills in interpreting the results, lack of time and delays in replacing exhausted consumables and faulty components of spirometer.
Conclusion: Gradually, the trend of spirometry request is increasing in UITH; however, a wider acceptability could be achieved for this test by raising the level of awareness and improving the skills of all doctors on the usefulness and interpretation of spirometry.

Keywords: Audit, challenges, respiratory disease, spirometry, utilization

Résumé

Arrière-plan: Spirométrie est un test physiologique invasive et rentable qui complète considérablement les autres procédures d'enquête dans l'évaluation des conditions respiratoires. Cette étude visait à la spirométrie effectuée à l'Université de l'hôpital d'enseignement Ilorin (UITH) Ilorin, Nigeria, l'audit et de mettre en évidence certains des défis liés à la procédure.
Méthodes: Nous a examiné et analysé l'enregistrement de spirométrie effectuée à l'unité de l'hôpital de juin 2002 à décembre 2009 de cardio-pulmonaires.
Résultats: Un total de 119 patients avait spirométrie tests depuis 2002 pour 2009 et leur âge variait de 15 à 85 ans avec une moyenne de 47.6 ± 14,8 ans. Il y avait des hommes (58%) 69 et le ratio hommes: femmes était 1.4:1. Plus de la moitié (65%) des tests étaient chez les patients < âgé de 50 ans. Le taux de spirométrie effectuée annuellement une augmentation de 12 (10,1%) en 2002 à 31 (26,1%) dans l'année 2009. Évaluation de l'asthme bronchique indiquait la plus commune pour la spirométrie (43 patients; 36,1%). La majorité des demandes (84 patients; 70,6%) étaient des médecins respiratoires adultes. Les défis identifiés étaient le manque de connaissance de la plage de maladies qui pourraient être étudiés par la spirométrie, manque de compétences dans l'interprétation des résultats, le manque de temps et de retards dans le remplacement des consommables épuisés et composants défectueuses de Spiromètre.
Conclusion: Progressivement, la tendance de la demande de la spirométrie augmente dans UITH; toutefois, une plus large acceptabilité pourrait être obtenue pour ce test par élever le niveau de sensibilisation et d'amélioration des compétences de tous les médecins sur l'utilité et l'interprétation de la spirométrie.

Mots-clés : Audit des maladies respiratoires, spirométrie, défis, utilisation

Introduction

Spirometry is the timed measurement of dynamic lung volumes during forced expiration and inspiration to quantify how effectively and how quickly the lungs can be emptied and filled.[1] It can also be used in the detection of respiratory disease in patients presenting with symptoms of breathlessness, wheeze, cough, stridor and in the differentiation of obstructive and restrictive ventilatory defects. The test can be useful in distinguishing respiratory from cardiac disease as the cause of breathlessness and also in screening for respiratory disease in certain high-risk situations (e.g. pre-employment in industries in which occupational asthma is prevalent).[1-3] The surgeons and anesthetists use spirometry for pre-operative risk assessment prior to anesthesia and abdominal or thoracic surgery.[1-4] Reduced force expiratory volume in one second (FEV1) has been found to be a marker for premature death from all causes as well as for cardiovascular mortality, independent of age, gender, and smoking history.[5,6] Furthermore, spirometry is also a long-term predictor for overall survival rates in both the genders and could be used as a tool in general health assessment.[7]

The World Health Organization (WHO) has projected that the global burden of chronic respiratory diseases will increase considerably in the future.[2] To reduce the extent of morbidity and mortality arising from respiratory diseases in low and middle income countries, there is a need for surveillance and early diagnosis of acute and chronic respiratory diseases.[8] High-tech diagnostic facilities like fiber-optic bronchoscope and computerized tomography scans are not readily available in most healthcare facilities across the country except for chest radiograph, microbiological and cytological studies of sputum specimens.

Spirometry is a noninvasive and cost-effective physiologic test that greatly complements other investigative procedures in the evaluation of respiratory conditions. Studies on spirometry had been conducted in the last two decades in Nigeria.[9-13] A recent study reported that knowledge and practice of spirometry were poor among hospital-based Nigerian doctors and that spirometer was unavailable in most hospitals.[14] However, where spirometry is available to the medical doctors, there is a dearth of data on its use in Nigerian hospitals. This study aims to contribute to the growing body of knowledge on spirometry locally by auditing the spirometry performed at the University of Ilorin Teaching Hospital (UITH) Ilorin, Nigeria, and highlighting some of the challenges associated with the procedure.

Material and Methods

We reviewed all the spirometry tests performed from June 2002 to December 2009 at UITH. Our center is a 459-bed hospital that functions as a primary, secondary and tertiary healthcare facility. The catchment areas of the hospital include the city of Ilorin and the adjoining towns. Referrals are also received from public and private hospitals in the neighboring states. The cost of spirometry is 750 Naira equivalent to US $5. All the spirometry tests were conducted by the respiratory physician and senior resident using the Spirolite spirometer 303, 2001 model (Serial no 8187) manufactured by Medical System International Corporation Greenvale NY 11548 USA. The procedure was conducted and the result interpreted in accordance with standardization requirement of the American thoracic society (ATS).[15] The records of the spirometry performed from June 2002 to December 2009 were retrieved from the database of the cardiopulmonary unit of the hospital; in addition, the total number of respiratory cases managed in the Department of Medicine during this period was also retrieved. Information in relation to patients' age, sex, body mass index, specialty of the physician requesting for the test, indication for test, type of spirometry (routine/reversibility/airway resistance) and outcome of the test results were extracted from spirometry register. The outcome of the test were classified as (1) normal if FEV1/FVC was >70%, (2) obstructive ventilatory defect if the ratio of Force Expiratory Volume in one second to Force Vital Capacity (FEV1/FVC) was <70%, (3) restrictive ventilatory defect if the FVC was less than 80% predicted and the FEV1/FVC was greater than 80%, and (4) mixed ventilatory defect if the FVC was less than 80% predicted and the FEV1/FVC was <70%.[15] The data analysis was done with Statistical Package for the Social Sciences, version 15.0 (SPSS Inc., Chicago, IL, USA). Descriptive and frequency statistics of general characteristics of the patients were performed; chi-square was used to determine the significance of the variables. A P value <0.05 was considered statistically significant.

Results

A total of 119 spirometry tests were performed in the hospitals during the study period. The age of

the patients ranged from 15 to 85 years with a mean of 47.6 ± 14.8 years and median of 47 years. There were 69 males (58%) and 50 females (42%). The male:female ratio was 1.4:1. Most of the patients who had the test (42.0%) belonged to the age group 40–49 years [Table 1]. The number of spirometry tests performed annually increased from 12 (10.1%) in 2002 to 31 (26.1%) in the year 2009. The most common indication was for evaluation of bronchial asthma (43 patients; 36.1%), followed by screening for occupational lung diseases (25 patients; 21.0%) and diagnosis of Chronic Obstructive Pulmonary Disease (COPD) in 23 (19.3%) patients [Table 2].

Of the 119 spirometry tests, 90 (75.6%) were routine spirometry (volume time and flow volume tests), while 19 (24.4%) were reversibility tests. Respiratory physicians requested for 84 (70.6%) of the tests, 25 (21%) were referred by family physicians/ general practitioner (GP), 4 (3.4%) by surgeons and 6 (5.0%) by other physicians [Table 3].

Outcome of the tests showed that 60 (50.4%) of the patients had obstructive ventilatory defect, 48 (40.3%) had a normal spirometry, 5 (4.2%) had mixed pattern, i.e., combination of obstructive and restrictive ventilatory defects, while 2 (1.7%) had restrictive ventilatory defect. Four patients (3.4%) had unacceptable result due to poor efforts and faulty method of blowing the spirometer [Table 4].

The trend of annual requests for spirometric test has been quite variable and low [Figure 1]. Clinical indications for the tests were, however, commonest for bronchial asthma, followed by COPD and preoperative evaluation. Lately, evaluation of unexplained dyspnea and screening for occupational lung diseases are becoming important indications for spirometric tests [Figure 2].

Discussion

Clinical audit in medical practice is a process that seeks to identify areas for service improvement, to develop and carry out action plans to rectify or improve service provision and then to re-audit

Table 1: Age and sex distribution of patients who had spirometry at UITH, Ilorin

Age range (years)	Male *n* (%)	Females *n* (%)	Total *n* (%)
<20	1 (1.4)	3 (6.0)	4 (3.4)
20–29	4 (5.8)	5 (10.0)	9 (7.6)
30–39	9 (13.0)	6 (12.0)	15 (12.6)
40–49	28 (40.6)	22 (44.0)	50 (42.0)
50–59	8 (11.6)	9 (18.0)	17 (14.3)
60–69	9 (13.0)	1 (2.0)	10 (8.4)
>	10 (14.5)	4 (8.0)	14 (11.8)

$\chi^2 = 8.7$; d. f. = 6; $P = 0.15$

Table 2: Indications for spirometry at UITH, Ilorin

Indications	*n* (%)
Asthma evaluation	43 (36.1)
Screening for occupational lung disease	25 (21.0)
COPD diagnosis	23 (19.3)
Pre-operative evaluation	6 (5.0)
Medical check-up	5 (4.2)
Chronic cough	4 (3.4)
Unexplained dyspnea	3 (2.5)
Smoking cessation	1 (0.8)
Nonspecific	9 (7.6)

Table 3: Sources of referral for spirometry test at UITH, Ilorin

Category	*n* (%)
Respiratory physicians	84 (70.6)
Family physicians/GP	25 (21.0)
Surgeons	4 (3.4)
Others	6 (5.0)

Table 4: Spirometry diagnosis in patients at UITH, Ilorin

Outcome	*n* (%)
Obstructive defect	60 (50.4)
Normal spirometry	48 (40.3)
Mixed pattern defect	5 (4.2%)
Restrictive defect	2 (1.7)
Poor effort/blow	4 (3.4)

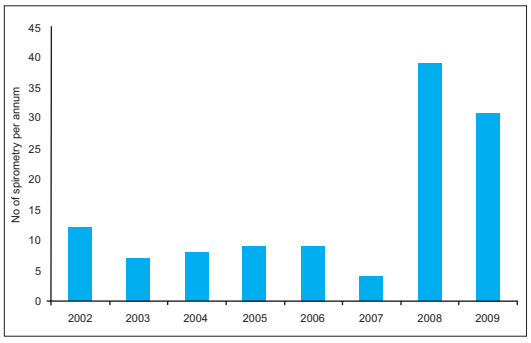

Figure 1: Annual trends of spirometry at UITH, Ilorin (2002–2009)

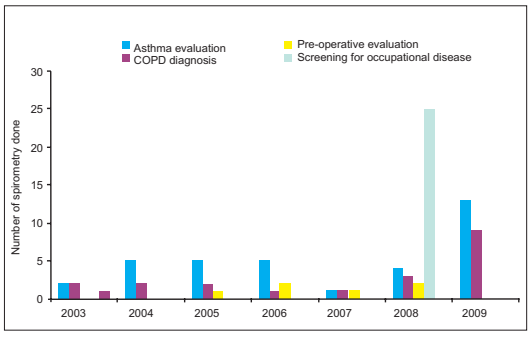

Figure 2: Trends of spirometry by indication (2002–2009)

to ensure that these changes have an effect.[16] The rate utilization of spirometry for evaluating pulmonary disorders in our center has increased from 12 (10.1%) to 31 (26.1%) in the year 2009. This increase was rather poor over a 7-year period, meaning that the full benefit of the test was not being utilized. The rate of utilization can be increased if awareness amongst doctors is improved and benefits of the test are explained to the patients. The finding of increased utilization of spirometry in our center is similar to an observation in south eastern Nigeria.[13] In settings where policy regarding evaluation of respiratory symptoms is encouraged and enforced, it often reflects in increased utilization of spirometry as a procedure.[17] Majority (65%) of the patients who had spirometry were below the age of 50 years, which agrees with the finding of a similar study[13] but differs from a Canadian study,[17] in which majority of the patients who underwent spirometry were elderly. This may be due to the fact that asthma, which is a condition that occurs more frequently <45 years of age, was the commonest indication for spirometry in our center. Our result is similar to what was reported in south eastern Nigeria and Australia[13,18] but is in contrast to a study in Nepal where COPD was the commonest indication for spirometry.[19] Although pulmonary tuberculosis (PTB), asthma and pneumonia were the commonest causes of respiratory morbidity in our localities,[20] only bronchial asthma requires spirometry for diagnosis. We also found that 70.6% of the patients who had the test were referred by respiratory physicians, followed by the family physicians/GP (21.0%), who were mostly from other private hospitals; our finding is similar to that of previous studies.[13,18] The reason for higher rate of referral by respiratory physician in our study may be due to poor appreciation of the importance of spirometry amongst non respiratory physician in patients' evaluation and partly due lack of sufficient knowledge and skills in interpreting the results of the spirogram. Petty in 2005 and Desalu *et al* in 2009 had highlighted these reasons as a barrier to the practice of spirometry.[14,21] The factors enumerated above could perhaps partly explain the initial low and variable annual distribution of spirometry in this center: 10.1% in 2002, less than 10% from 2003 to 2007. The upsurge to 32.8% in 2008 was mainly due to the batch screening of bank workers to exclude occupation-related lung diseases due persistent handling of dirty and dust notes.

Generally, factors militating against comprehensive utilization of spirometry in this center could be grouped into two: (1) human; doctors and non doctors' related factors and (2) logistics and administrative factors. The former include, as earlier mentioned, poor appreciation of the importance and role of spirometry in the management of respiratory diseases as well as poor knowledge and skills of interpreting results of spirogram amongst the generality of non respiratory physicians in the hospital. There is no respiratory scientist in the employment of the hospital to conduct the tests and this explains why the conduct of the test becomes the responsibility of the respiratory physicians. However, this is an additional responsibility on a rather choked clinical and teaching schedule and this may sometimes affect the rate and quality of the spirometry conducted. Logistic problems such as delay in replenishing the exhausted consumables and repairing of faulty components of the spirometer are other factors impacting negatively on the conduct of spirometry. Despite the challenges of spirometry, there are rooms for improvement to overcome these challenges. The respiratory unit and the hospital management need to organize a continuous medical education program for all healthcare workers in the hospital. This should be used to raise their awareness and broadened their knowledge on spirometry. Clinical importance of spirometry in the evaluation of respiratory disorders also needs to be emphasized.

Conclusion

The clinical application of spirometry is rather poor in our hospital and the reasons for these are both physician and management related. These could, however, be resolved by continuous medical education for both the cadres of hospital workers.

Acknowledgment

We would like to specially thank the Head of cardiopulmonary unit of the Department of Medicine for the assistance provided in retrieving patients' data.

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Source of Support: Nil, **Conflict of Interest:** None declared.