4. Al-Nozha MM, Al-Maatouq MA, Al-Mazrou YY, Al-Harthi SS, Arafah MR, Khalil MZ, Khan NB, Al-Khadra A, Al-Marzouki K, Nouh MS, Abdullah M, Attas O, Al-Shahid MS, Al-Mobeireek A. Diabetes mellitus in Saudi Arabia. Saudi Med J. 2004; 25: 1603-1610.

5. Roglic G, Unwin N, Bennett PH, Mathers C, Tuomilehto J, Nag S, Connolly V, King H. The burden of mortality attributable to diabetes: realistic estimates for the year 2000. Diabetes Care. 2005; 28(9): 2130-2135.

6. Lahoz-Rallo B, Blanco-Gonzalez M, Casas-Ciria I, Marín-Andrade JA, Mendez-Segovia JC, Moratalla-Rodriguez G, Quintero-Dominguez R, Ramirez-Raya M, Guerrero-Pinedo MJ, Aguilar-Diosdado M. Cardiovascular disease risk in subjects with Type 2 diabetes mellitus in a population in southern Spain. Diabetes Res Clin Pract. 2007; 76(3): 436-444.

7. Soto-Pedre E, Hernaez-Ortega MC, Piniés JA. Duration of diabetes and screening coverage for retinopathy among patients with Type 2 diabetes. Ophthalmic Epidemiol. 2007; 14(2): 76-79.

8. Akbar DH, Ahmed MM, Algamdi AA. Cardiovascular risk factors in Saudi Arabian and non-Saudi Arabian diabetic patients in Saudi Arabia. East Mediterr Health J. 2003; 9(5-6): 884-892.

9. Stratton IM, Adler AI, Neil HA, Matthews DR, Manley SE, Cull CA, Hadden D, Turner RC, Holman RR. Association of glycemia with macrovascular and microvascular complications of Type 2 diabetes (UKPDS 35): prospective observational studies. BMJ. 2000; 321(7258): 405-412.

10. Kim SI, Kim SJ. Prevalence and risk factors for cataracts in persons with Type 2 diabetes mellitus. Korean J Ophthalmol. 2006; 20(4): 201-204.

11. Al-Homrany MA, Abdulmoneim I. Significance of proteinuria in Type 2 diabetic patients treated at a primary health care in Abha City, Saudi Arabia. West Afr J Med. 2004; 23(3): 211-214.

12. Adler AI, Stratton IM, Neil HA, Yudkin JS, Matthews DR, Cull CA, Wright AD, Turner RC, Holman RR. Association of systolic blood pressure with macrovascular complications of Type 2 diabetes (UKPDS 36): prospective observational study. BMJ. 2000; 321(7258): 412-419.

13. Janghorbani M, Rezvanian H, Kachooei A, Ghorbani A, Chitsaz A, Izadi F, Amini M. Peripheral neuropathy in Type 2 diabetes mellitus in Isfarhan, Iran: prevalence and risk factors. Acta Neurol Scand. 2006; 114(6): 384-391.

14. Famuyiwa OO, Sulimani RR, Laajam MA, Al-Jasser SJ, Mekki MO. Diabetes mellitus in Saudi Arabia: The clinical pattern and complications in 1,000 patients. Ann Saudi Med. 1992; 12(2): 140-151.

15. Alwakeel JS, Sulimani R, Al-Asaad H, Al-Harbi A, Tarif N, Al-Suwaida A, Al-Mohaya S, Isnani AC, Alam A, Hammad D. Diabetes complications in 1952 Type 2 diabetes mellitus patients managed in a single institution. Ann Saudi Med. 2008; 28(4): 260-266.

16. Akbar DH. Is hypertension common in hospitalized Type 2 diabetic patients? Saudi Med J. 2001; 22(2): 139-141.

17. El-Asrar AM, Al-Rubeaan KA, Al-Amro SA, Kangave D, Moharram OA. Risk factors for diabetic retinopathy among Saudi diabetics. Int Ophthalmol. 1998; 22(3): 155-161.

18. Huraib S, Abu-Aisha H, Sulimani RA, Famuyiwa FO, Al-Wakeel J, Askar A, Sulimani F. The pattern of diabetic nephropathy among Saudi patients with noninsulin-dependent diabetes mellitus. Ann Saudi Med. 1995; 15(2): 120-124.

19. Alzaid AA, Sobki S, De Silva V. Prevalence of microalbuminuria in Saudi Arabians with non-insulin-dependent diabetes mellitus: a clinic based study. Diabetes Res Clin Pract. 1994; 26(2): 115-120.

20. Nelson RG, Bennett PH, Beck GJ, Tan M, Knowler WC, Mitch WE, Hirschman GH, Myers BD. Development and progression of renal disease in Pima Indians with non-insulin-dependent diabetes mellitus. Diabetic Renal Disease Study Group. N Eng J Med. 1996; 335(22): 1636-1642.

21. Qidawi SA, Khan MA, Hussain SR, Malik MS. Diabetic neuroarthropathy. Saudi Med J. 2001; 22(2): 142-145.

SAUDI JOURNAL OF INTERNAL MEDICINE
VOLUME 1 NO. 1 1432 H - 2011 G

KING FAHAD NATIONAL GUARD HOSPITAL INTERNAL MEDICINE CONSULTATION SERVICE: CONTRIBUTING CO-MORBIDITIES AND REASONS FOR CONSULTATION

Faisal A. Al-Asmari, MBBS, Farhan Z. Al-Enezi, MBBS, Nourah M. Alaskar, MBBS, Salih A. Bin Salih MD, FACP, and Imad S. Hassan MD, FACP
King Abdulaziz Medical City
King Fahad National Guard Hospital
Riyadh, Saudi Arabia

ABSTRACT

Background: Inpatient medical consultations have become an essential service in the specialty of Internal Medicine. Research in this new subspecialty will help improve the quality as well as the cost-effectiveness of this vital service.

Method: Data for all patients who were referred to the service were entered in a pre-designed form.

Results: One hundred and seventy-six adult patients with an average age of 53.3 years were seen by the service over a 4 months period. Consultations to the service were primarily from the departments of Surgery (110, 62.50%), Obstetrics and Gynecology (57, 32.39%). Co-morbidities were common specially *diabetes mellitus* (59.1%) and hypertension (41.5%). Most of the consultations were for emergency patients (99, 56.3%) rather than for electively (77, 43.7%) admitted cases. For operative patients, there was an equal share between pre- and post-operative cases (58.8% and 58.0% respectively). Prior referral to outpatient pre-operative clinics was unsatisfactory with the service requesting postponements of surgery for 22.1 percent of pre-operative cases. The major reasons for referral to the service were diabetes mellitus (49.4%), hypertension (30.7%) and respiratory problems (22.7%). Thirty-three percent of cases had more than one reason for referral. Active intervention by the service was frequent. The average length of care under the service was 5.2 days with a range of 1 to 90 days.

Conclusions: The service needs to be structured with regards to staff education and training; emphasizing on diabetes mellitus, hypertension and respiratory problems care. A joint interdepartmental effort along the above lines and better use of the pre-operative outpatient clinics are recommended.

Keywords: Internal Medicine, Consultation service, Residents, Training, Quality

Address for Correspondence:

DR. IMAD S. HASSAN
Consultant Physician
Division of Internal Medicine,Department of Medicine 1443
King Abdulaziz Medical City
King Fahad National Guard Hospital
P.O. Box 22490, Riyadh 11426, Saudi Arabia
e-M: imadsahassan@yahoo.co.uk, hassani@ngha.med.sa

INTRODUCTION

Perioperative as well as non-perioperative medical consultations have become a new formal service within the specialty of Internal Medicine with dedicated staff and resources[1,2]. Research in this new subspecialty will help improve the quality as well as the cost-effectiveness of this vital service. The objectives of this research were to quantitate the consultation workload and to explore the reasons for the consultations, moreover, the outcome of the medical intervention. The study may also help provide some insights on possible improvements to the service, both in terms of training of staff and patient care. The latter issues are especially relevant as residents in training are mostly exposed to a quantitatively and qualitatively different spectrum of medical problems in consultations to those seen on the acute ward service and in many centers. This input is viewed as a service rather than an educational exercise[3,4].

DESIGN, PATIENTS AND SETTING

This was a prospective study that has been undertaken at King Abdulaziz Medical City, Riyadh, Kingdom Saudi Arabia; a 1,200 bedded tertiary care centre. All patients who are referred to the internal medicine consultation service were included in the study.

METHODS

Data for all patients who are were referred to the service were entered in a pre-designed form containing patient's demographics, referring specialty, reason(s) for referral, co-morbid conditions, and suggested medical interventions, plus the outcome of these interventions and duration of care under the consultation service. Simple statistical tests were used to analyze the data.

RESULTS

Characteristics of Patients and Sources of Consultation

One hundred and seventy-six patients were seen by the service over a 4-months period. Sixty-eight (38.6%) were male and 108 (61.4%) were female with an average age of 59.9 (range 18-95) and 46.8 (range 13-100) years, respectively. The majority of patients were elderly patients (average age 58.2 yrs); referrals from obstetrics were excluded. Consultations to the service were primarily from the departments of Surgery (110, 62.50%), Obstetrics and Gynecology (57, 32.39%) (Table 1). Most consultations were for emergency patients (99, 56.3%) rather than for electively admitted cases (77, 43.7%). Peri-operative consultations constituted 74.4% (131) of all requests. For these patients there was an equal share between pre- and post-operative cases (58.8% 77 patients and 58.0% 76 patients, respectively). The service was consulted both pre- as well as post-operatively for some patients. Of 70 electively admitted, operative patients with complete entries only seven (10%) were previously seen in pre-operative or anesthesia clinics.

Co-morbidities

Co-morbidities were common with 84.7% (149 patients, 84.7%) having a co-morbid disease, of whom 49.4% (87 patients) had two, 20.5% (36 patients) had three and 7.4% (13 patients) had four co-morbidities. Major co-morbidities included *diabetes mellitus* (DM) (59.1%, 104 patients, including gestational diabetes - 14 patients), hypertension (41.5%, 73 patients including gestational hypertension), bronchial asthma (12.5%, 22 patients), cardiac disease (8.5%, 15 patients) and renal disease (5.1%, 9 patients).

Reasons for Referral to the Service

The major reasons for referral to the service were DM (49.4%), hypertension (30.7%) and respiratory problems (22.7%) (Table 2). Thirty-three percent of cases had more than one reason for referral. Forty-five patients (25.6 %) had two reasons for referral and 14 (7.8%) had three reasons for referral.

Interventions and Outcome of the Consultation

Active intervention by the service in patient management was commonplace with its implication for further in-patient

Table 1. Referring Specialties.

Referring Specialty	Count	Percentage
Surgery	**110**	**62.50**
General Surgery	31	17.61
Orthopedics	27	15.34
Vascular Surgery	18	10.23
Plastic Surgery	9	5.11
Ophthalmology	6	3.41
Urology	6	3.41
Neurosurgery	5	2.84
Maxillofacial	2	1.14
ENT*	3	1.70
Dental	2	1.14
Podiatry	1	0.57
Obstetrics & Gynecology	**57**	**32.39**
Obstetrics	43	24.43
Gynecology	14	7.95
Medicine	**9**	**5.11**
Cardiology	3	1.70
GIT†	3	1.70
Neurology	2	1.14
Hepatology	1	0.57

* *Ear Nose and Throat Surgery Specialty*
† *Gastroenterology Specialty*

Table 2. Reason(s) for Referral.

Clinical Reason*	Count	Percent
Diabetes Mellitus (including gestational diabetes)	**87**	**49.43**
Hypertension	**54**	**30.68**
Respiratory Disease	**40**	**22.72**
Bronchial Asthma	13	32.50
Pneumonia / Respiratory Tract Infection	8	20.00
Shortness of Breath	6	15.00
Suspected Pulmonary Embolism	5	12.50
Evaluation of Cough	4	10.00
Hypoxia	3	7.50
Bronchiectasis	1	2.50
Medical Clearance	**15**	**8.62**
Hematologic Disease	**9**	**5.17**
Cardiac Disease	**4**	**2.23**
Neurologic Disease	**6**	**3.44**
Gastroenterologic Disease	**4**	**2.23**
Transfer of Care	**3**	**1.72**

* *Some patients had multiple reasons for referral.*

Table 3. Nature of Advice or Intervention.

Clinical Intervention	Count	Percentage (%)	Number Admitted Electively
Requested more tests	97	55.11	
Suggested changes to current treatment	127	72.16	
Suggested referral to another specialty	48	27.27	
Requested postponement of surgery (in 70 pre-operative consultations)	17*	22.08	10 (58%)†

* *12 did not have surgery altogether.*

† *None was seen in pre-operative / anesthesia clinics.*

follow-up and further advice (Table 3). Changes to current treatment and request for more tests were ordered for 72.2% and 55.1% of patients, respectively. The service requested postponements of surgery for 22.1% of pre-operative cases. The average length of care under the service was 5.2 days with a range of 1 to 90 days. On their discharge from the service, the majority of patients were judged as improved apart from 9 individuals whose condition worsened post-consultation.

DISCUSSION

The primary goal of a specialist consultation service is the provision of expert advice that would guarantee better clinical outcomes and expedite discharge. Identifying the most common reasons for inpatient consultation, directed education and training of staff on these clinical conditions are paramount if these objectives are to be realized[3,4]. Our study clearly facilitates in fulfilling these objectives as it has highlighted the frequency and nature of the commonly referred conditions. Almost half of all referrals were due to DM and 60% of all referred patients had a previous diagnosis of DM. This finding, although not unexpected in the Kingdom of Saudi Arabia, is extremely significant partly because of its implication for staff education and training as emphasized above (redesigning the educational curricula), and also, partly for the known impact of DM on cost of care.

Inpatient hyperglycemia due to DM has been associated with nosocomial infections, increased mortality, and an increased length of stay[5]. Several observational, non-randomized trials have shown that decreasing hyperglycemia

lessen morbidity and mortality in all patients, regardless of a prior history of diabetes[6]. Furthermore, interventions for better inpatient glycemic control may have a longer-term (post-discharge) impact on diabetes care if appropriately utilized. The latter 'bonus" achievement has recently being confirmed in a study where endocrinologist-directed interventions for inpatient diabetes consultations lead to a significant improvement in HbA_{1c} (from 10.1 to 8%) over a 12 months period of follow-ups[7]. It is worth mentioning, that the use of sliding scale subcutaneous insulin regimes for inpatient glucose control is not recommended[6,8] and that a dedicated "diabetes-team" consultation service seems to lead to a shorter hospital-stay[9]. Likewise, hypertension and respiratory difficulties which comprise the other major reasons for referrals necessitate proper and directed interventions. Effective preoperative control of the blood pressure is associated with a better intra-operative as well as postoperative outcomes[10,11]. Approximately, 25% of all the immediate postoperative deaths are related to pulmonary complications[12]. Patient-, operative-, anesthetic- and postoperative care-related risk assessment as well as specific risk reduction strategies need to be employed to lessen the impact of these complications[13].

Another finding of the study is the poor utilization of the pre-operative and anesthesia clinics for electively admitted patients. A service that is available at KAMC and where patients are seen within a few days after referral. This has resulted in a request for postponement of surgery in a sizable proportion of patients post-admission with its implication for resource utilization and hospital cost of care. The magnitude of the interventions, the need to follow-up the results of requested investigations, and the average duration of follow-up are a witness to the large workload of the service. Most consultation encounters result in a successful outcome (as judged by the service members) in that the patients improved following the intervention. The study did not specifically look at the input of the service qualitatively, appropriateness of the referrals, timeliness of the service input, cost of the intervention, nor the patients' or the referring specialty's satisfaction with the service; aspects in the consultation service that also warrant investigating.

The following suggestions for improving the service were proposed:

1. Structuring of the service with emphasis on education and training on the management of the frequently referred medical conditions namely diabetes mellitus, hypertension and respiratory problems.
2. A joint Department of Medicine (Divisions of Internal Medicine and Endocrinology), Department of Surgery and Department of Obstetrics, and Gynecology program on training of their junior staff. Moreover, on guidelines implementation for the above conditions may help improve and streamline the quality of care the patients receive. Along that line, a newly designed referral form, specifically for patients with DM, was introduced to complement the peri-operative diabetes protocol form. Essential clinical information and evidence-based advice are incorporated in the form.
3. There should be more use of outpatient pre-operative internal medicine and anesthesia clinics; a service that is already available at this institute.

REFERENCES

1. Cohn SL. The role of the medical consultant. Med Clin North Am. 2003; 87(1): 1-6.
2. Mollema R, Berger P, Girbes AR. The value of peri-operative consultation on a general surgical ward by the internist. Neth J Med. 2000; 56(1): 7-11.
3. Lewis JB, Morrison RE, Arnold A. Using a general internal medicine consult service to teach residents and care for patients. Am J Med Sci. 2003; 326(2): 73-78.
4. Moore RA, Kammerer WS, McGlynn TJ, Trautlein JJ, Burnside JW. Consultations in internal medicine: a training program resource. J Med Educ. 1977; 52(4): 323-327.
5. Hirsch IB, Paauw DS, Brunzell J. Inpatient management of adults with diabetes. Diabetes Care. 1995; 18(6): 870-878.
6. ACE/ADA Task Force on Inpatient Diabetes. American College of Endocrinology and American Diabetes Association consensus statement on inpatient diabetes and glycemic control. Endocr Pract. 2006; 12 Suppl 3: 4-13.
7. Baldwin D, Villanueva G, McNutt R, Bhatnagar S. Eliminating inpatient sliding-scale insulin: a reeducation project with medical house staff. Diabetes Care. 2005; 28(5): 1008-1011.
8. Browning LA, Dumo P. Sliding-scale insulin: an antiquated approach to glycemic control in hospitalized patients. Am J Health Syst Pharm. 2004; 61(15): 1611-1614.
9. Levetan CS, Salas JR, Wilets IF, Zumoff B. Impact of endocrine and diabetes team consultation on hospital length of stay for patients with diabetes. Am J Med. 1995; 99(1): 22-28.
10. Goldman L, Caldera DL. Risks of general anesthesia and elective operation in the hypertensive patient. Anesthesiology. 1979; 50(4): 285-292.
11. Stone JG, Foëx P, Sear JW, Johnson LL, Khambatta HJ, Triner L. Risk of myocardial ischemia during anesthesia in treated and untreated hypertensive patients. Br J Anaesth. 1998; 61(6): 675-679.
12. Brook-Brunn JA. Postoperative atelectasis and pneumonia. Heart Lung. 1995; 24(2): 94-115.
13. Arozullah AM, Conde MV, Lawrence VA. Preoperative evaluation for postoperative pulmonary complications. Med Clin North Am. 2003; 87(1): 153-173.

SAUDI JOURNAL OF INTERNAL MEDICINE
VOLUME 1 NO. 1 1432 H - 2011 G

THE DIAGNOSTIC VALUE OF FORCED EXPIRATORY TIME

Siraj O. Wali, FRCPC, FCCP
Department of Internal Medicine, Faculty of Medicine
King Abdulaziz University, Jeddah, Saudi Arabia

ABSTRACT

Objective: Airway obstruction can be clinically quantified at the bedside by measuring the time taken for forced expiration. The aim of this study was to examine the accuracy of the forced expiratory time in detecting airflow limitation, and small airway disease when compared with simple spirometry as a gold standard test.

Method: Simple spirometry and forced expiratory time were performed on 201 subjects (age range; 12-81 years), referred to a pulmonary function laboratory at a tertiary care hospital. The diagnostic accuracy of forced expiratory time and its correlation with spirometric parameters were tested. Forced expiratory time ≥ 6 seconds was regarded as abnormal, and the ratio of forced expiratory volume in the first second to forced vital capacity of < 70% was considered indicative of an airflow limitation.

Results: Forced expiratory time was found to correlate weakly with spirometric parameters. Forced expiratory time at a cut-off value of ≥ 6 seconds had a sensitivity of 61% and a specificity of 79% in predicting obstructive airway disease when compared with simple spirometry. On the other hand, the sensitivity and the specificity of forced expiratory time in predicting small airway disease were 47% and 86%, respectively.

Conclusion: Forced expiratory time does not correlate well with all parameters of a simple spirometry. Its sensitivity and specificity for detecting airflow limitation and small airway disease were not high enough to be used as a diagnostic test. However, it may be a helpful test to be used to support the diagnosis of small airway disease.

Keywords: Forced expiratory time, Mid-expiratory flow, FEV_1/FVC ratio, Small airway disease

Address for Correspondence:

DR. SIRAJ O. WALI
Assistant Professor of Medicine
Department of Medicine, Faculty of Medicine
King Abdulaziz University
P.O. Box 4377, Jeddah 21491, Saudi Arabia
e-M: sirajowali@gmail.com

OBJECTIVES

Obstructive airway disease is characterized by a slower expiratory phase. Normally, the forced expiratory volume in the first second (FEV_1) is ≥70% of the forced vital capacity (FVC), and hence, an FEV_1/FVC ratio of < 70% is indicative of an airflow limitation[1]. A study in a random population sample, found that the post-bronchodilator FEV_1/FVC ratio exceeded 70% in all age groups, supporting the use of this fixed ratio[2].

Airway obstruction can also be clinically quantified at the bedside by measuring the time taken for forced expiration. This can be measured as the forced expiratory time (FET) using a stethoscope and a stopwatch. The simplicity of this test has attracted many supporters of this simple bedside tool, which requires no equipment whatsoever to assess obstructive airway disease. The association between FET and airway obstruction was recognized more than half a century ago[3,4]. Earlier studies indicated that FET correlates best with the FEV_1/FVC ratio[5,6] and recommended the use of FET as a useful bedside test for the diagnosis of airway obstruction. However, more recent reports suggest that less emphasis should be placed on prolonged FET when making a diagnosis of an obstructive airway disease[7-9]. However, there is controversy in the limited reported literature regarding the efficacy of FET in diagnosing airway obstruction, as well as the lack of consistency in the cut-off normal value applied.

In this study, the diagnostic accuracy of FET for obstructive airway disease and its correlation with simple spirometric parameters were tested.

METHODS

This was a cross-sectional diagnostic test study. All consecutive subjects that were referred to a pulmonary function laboratory in a tertiary hospital over a 6-month period were recruited. All candidates agreed verbally to participate in this study. Each candidate completed a simple spirometry test and had FET measured.

A standard protocol for simple spirometry was followed according to the American Thoracic Society Standards[10]. The diagnosis of obstructive lung disease was based on the spirometric findings; the FEV_1 was < 70% of the FVC[1,10]. FET was assessed by asking the patient to sit upright and take a deep breath in and then breath out, with the mouth open, as quickly and completely as possible. The instructor listened over the upper trachea in the suprasternal notch with the bell of a stethoscope. The duration of the audible-exhalation was timed to the nearest second using a stopwatch. Normally, the audible-exhalation should last < 6 seconds. Three consistent readings were obtained, allowing a short rest between efforts. The average FET in seconds was then calculated. Each FET trial was performed simultaneously with the simple spirometry test, which was performed using the SENSORMEDICS Vmax 229 Auto Box System PFT (JAEGER, Germany). One senior technician assessed all patients.

The data were entered on an excel database. The correlation between FET and the FEV_1/FVC ratio and the other spirometry parameters was assessed using Pearson correlation (pair-wise deletion).

Sensitivity was calculated as the probability that the FET was abnormally prolonged. The accuracy of the FET test, with a cut-off value of 6 seconds for assessing the presence of airway obstruction was determined (true positives/true positives plus false negatives). Specificity was calculated as the probability that FET was normal when airway obstruction was not present (true negatives/true negatives plus false positives).

Receiver Operating Curves (ROC) used to assess accuracy or efficiency were defined as the sum of the true positives, plus the true negatives; divided by the sum of the true positives, true negatives, false positives, and false negatives.

RESULTS

The study included a total of 201 subjects between the ages of 12–81 years, of which 103 were male. Among these subjects, based on spirometric findings, 63 had normal spirometric recordings, 58 exhibited an obstructive pattern (OP), 40 exhibited a restrictive pattern, and 40 exhibited a mixed pattern. The measurement of FET demonstrated that 60 subjects had prolonged (abnormal) FET, whereas the remaining 141 subjects had normal values. However, the average FET ranged between 1.1–13.6 seconds (Table 1).

Correlations of FET with spirometric parameters are shown in Table 2. These correlations, although, greatest with the FEV_1/FVC ratio (0.58), in general were not strong enough to consider FET an effective diagnostic test for airway limitation. In addition, the correlation of FET with spirometric parameters did not improve even when only subjects with obstructive airway disease were included, as shown in Table 3.

Using the ROC data, it was revealed that FET at a cut-off value of ≥ 6 seconds had a sensitivity of 61%, and a specificity of 79% in predicting OP in comparison with simple spirometry using the FEV_1/FVC ratio cut-off value of < 70%. On the other hand, at a cut-off value of ≥ 6 seconds, the sensitivity and specificity of FET in predicting small airway disease, which is often diagnosed based on a MEF of less than 65% predicted, were 47% and 86%, respectively.

However, when only the data from clinically suspected cases of obstructive airway disease (118 cases) were considered, the sensitivity and specificity of FET as a diagnostic tool for OP were 55% and 70%, respectively. In this subgroup, the mean FET in subjects with documented OP based on spirometry was 6.26 ± 3.12 seconds.

Table 1. Comparison of respiratory disease patterns between subjects.

Index (Mean)	Unit	Normal (n = 63)	OP (n = 58)	RP (n = 40)	MP (n = 40)	TOTAL (n = 201)
FET	s	3.26 ± 2.14	6.04 ± 3.03	3.06 ± 2.17	4.48 ± 2.34	2.0
FEV_1 Predicted	L %	2.72 ± 0.73 (94.1 ± 10.1)	1.60 ± 0.8 (58.9 ± 20.7)	2.05 ± 0.62 (70.5 ± 14.2)	1.62 ± 0.53 (61 ± 11.6)	2.04 ± 0.08 (72.66 ± 21.14)
FVC Predicted	L %	3.28 ± 0.90 (88.8 ± 9.9)	2.46 ± 1.03 (69.4 ± 17.7)	2.40 ± 0.80 (63.8 ± 13.4)	2.07 ± 0.71 (60.1 ± 12.3)	2.63 ± 0.99 (72.50 ± 17.8)
RATIO	%	83.17 ± 3.85	62.84 ± 10.42	86.98 ± 4.91	78.33 ± 5.96	76.90 ± 11.56
Predicted MEF	%	93.83 ± 20.74	30.88 ± 17.46	83.63 ± 15.05	49.42 ± 12.55	(64.79 ± 31.8)
PEF Predicted	L/min %	6.66 ± 2.26 (95.0 ± 20.7)	4.39 ± 1.79 (65.5 ± 20.6)	6.20 ± 1.90 (89.2 ± 18)	4.74 ± 1.83 (71.5 ± 18.3)	5.53 ± 2.20 (80.60 ± 23.33)

FET = Forced expiratory time; FEV_1 = Forced expiratory volume in the first second; FVC = Forced vital capacity; MEF = Mid-expiratory flow; MP = Mixed pattern; OP = Obstructive pattern; PEF = Peak expiratory flow; RP = Restrictive pattern

Table 2. Correlation of FET and simple spirometric parameters in the study population.

Indices	Correlation Coefficient
FEV_1 *vs.* FET	-0.36
Ratio *vs.* FET	-0.58
FVC *vs.* FET	-0.17
MEF *vs.* FET	-0.49
PEF *vs.* FET	-0.36

FET = Forced expiratory time; FEV_1 = Forced expiratory volume in the first second; FVC = Forced vital capacity; MEF = Mid-expiratory flow; PEF = Peak expiratory flow

Table 3. Correlation of FET and spirometric parameters in patients with airway obstruction (obstructive pattern by spirometry).

Indices	Correlation Coefficient
FEV_1 *vs.* FET	-0.44
Ratio *vs.* FET	-0.50
FVC *vs.* FET	-0.30
MEF *vs.* FET	-0.40

FET = Forced expiratory time; FEV_1 = Forced expiratory volume in the first second; FVC = Forced vital capacity; MEF = Mid-expiratory flow

DISCUSSION

Our data indicate that the sensitivity and specificity of FET as a screening test for obstructive airway disease, when used for all subjects with suspected pulmonary disease, were 61% and 79%, respectively. These results support the findings that have recently been reported in the literature. Badgett *et al.*[7], using a cut-off normal value of < 4 seconds, reported a low specificity and sensitivity of FET (49% and 77%, respectively). More recently, Straus *et al.*[8] suggested that, when making a diagnosis of chronic obstructive pulmonary disease (COPD), less emphasis should be placed on the individual findings of prolonged FET. However, the same authors suggested that a combination of 3 symptoms and signs (self-reported history of COPD, presence of wheezing on auscultation, and FET ≥ 9 seconds) can be used to predict obstructive airway disease[8]. In contrast, a study by Kern and Patel[9] reported a relatively high sensitivity and reproducibility for FET (93%). However, despite these findings, the test could not be recommended as a diagnostic clinical tool for airway obstruction due to its extremely low specificity (43%)[9].

Although, our findings and others may suggest that FET is a reasonable test to support the diagnosis of obstructive airway disease, the test cannot be used as a diagnostic test on

its own for this condition, considering its limited sensitivity and specificity. Furthermore, the sensitivity and specificity of the test (55% and 70%, respectively) did not improve when only subjects with clinical suspicion of obstructive airway disease were included, which may cast some doubt on its diagnostic value even as a supportive test.

While the concept of small airway (< 2 mm in internal diameter) disease developed in the 1970s, several researchers reported that FET might be a useful index for small airway obstruction in patients with normal spirometry[11,12]. However, Macdonald *et al.*[13] reported that FET poorly correlates with MEF, which is the standard simple measurement for small airway obstruction. This finding was also reported by Kern and Patel[9] in the above-mentioned study, which revealed a sensitivity and specificity of 60% and 44%, respectively. In our study, when FET was used as a diagnostic test for small airway disease, FET was observed to have a relatively higher specificity (86%), but its sensitivity was as poor as that for obstructive airway disease. This finding indicates that FET can be a satisfactory test to support the diagnosis of small airway disease, but not as a diagnostic test, given its relatively low positive predictive value (77%). In addition, the negative predictive value of FET is also not high enough (71%) to be considered a reliable screening test for small airway disease.

The current study, unlike others, examined the diagnostic value of FET among a population sample with a wide variety of lung diseases and was not limited to patients with suspected obstructive airway disease. However, the population sample used was actually derived from patients with suspected pulmonary disorders referred to the pulmonary function laboratory, rather than from the general population. Therefore, the role of this test as a screening test for obstructive airway disease among the general population cannot be determined.

CONCLUSIONS

In conclusion, our study showed that FET does not correlate well with the FEV_1/FVC ratio and MEF. In addition, the sensitivity and specificity of FET for detecting airflow limitation, as determined by an FEV_1/FVC ratio of < 70%, were not high enough for the test to be used alone for the diagnosis of airflow limitation. In contrast, its specificity for the diagnosis of small airway disease was 87%, which may be high enough for FET to be used as a supportive test in this clinal setting. However, the sensitivity of FET for the diagnosis of small airway disease is very low for it to be used alone as a diagnostic test.

ACKNOWLEDGEMENTS

The author is appreciative for the assistance of Dr. Abdulaziz Boker, Associate Professor of Anesthesiology, King Abdulaziz University, in performing the statistical analysis.

REFERENCES

1. [No authors listed]. Global Initiative for Chronic Obstructive Lung Disease. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease. 2009. <http://www.goldcopd.com>
2. Johannessen A, Lehmann S, Omenaas ER, Eide GE, Bakke PS, Gulsvik A. Post-bronchodilator spirometry reference values in adults and implications for disease management. Am J Respir Crit Care Med. 2006; 173(12): 1316-1325.
3. Roy J, Chapin HB, Favre J. Studies in pulmonary ventilatory function. I. Vital capacity, first one-second capacity, and forced respiration curves in patients with asthma; comparative evaluation of methods. J Allergy. 1955; 26(6): 490-506.
4. Comroe JH. The Lung: Clinical Physiological and Pulmonary Function Tests. Chicago: Year Book Publishers, 1955.
5. Rosenblatt G, Stein M. Clinical value of the forced expiratory time measured during auscultation. N Engl J Med. 1962; 267: 432-435.
6. Lal S, Ferguson AD, Campbell EJ. Forced expiratory time: a simple test for airways obstruction. Br Med J. 1964; 1(5386): 814-817.
7. Badgett RG, Tanaka DJ, Hunt DK, Jelley MJ, Feinberg LE, Steiner JF, Petty TL. Can moderate chronic obstructive pulmonary disease be diagnosed by historical and physical findings alone? Am J Med. 1993; 94(2): 188-196.
8. Straus SE, McAlister FA, Sackett DL, Deeks JJ. The accuracy of patient history, wheezing, and laryngeal measurements in diagnosing obstructive airway disease. CARE-COAD1 Group. Clinical Assessment of the Reliability of the Examination-Chronic Obstructive Airways Disease. JAMA. 2000; 283(14): 1853-1857.
9. Kern DG, Patel SR. The diagnostic value of the forced expiratory time. JAMA. 1994; 271(1): 25.
10. [No authors listed]. Statement Standardization of Spirometry, 1994 Update. American Thoracic Society. Am J Respir Crit Care Med. 1995; 152(3): 1107–1136.
11. McFadden ER Jr, Linden DA. A reduction in maximal mid-expiratory flow rate. A spirographic manifestation of small airway disease. Am J Med. 1972; 52(6): 725-737.
12. Cochrane GM, Benater SR, Davis J, Collins JV, Clark TJ. Correlation between tests of small airway function. Thorax. 1974; 29(2): 172-178.
13. Macdonald JB, Cole TJ, Seaton A. Forced expiratory time--its reliability as a lung function test. Thorax. 1975; 30(5): 554-559.

SAUDI JOURNAL OF INTERNAL MEDICINE
VOLUME 1 NO. 1 1432 H - 2011 G

TUBERCULOSIS-RELATED SUDDEN DEATH: A CASE REPORT AND REVIEW OF THE LITERATURE

Atif W. Qubbany[1], MBBS, Asim K. Saleh[2], MRCP (UK), FACP, Muntasir M. Abdelaziz[3], FRCP (Glasg), PhD (London) and Abdulhakeem O. Al Thaqafi[1], SBIM, ArBIM

[1]Department of Medicine, King Abdulaziz Medical City, National Guard Health Affairs, Jeddah, Saudi Arabia
[2]Department of Medicine, International Medical Center, Jeddah, Saudi Arabia
[3]Department of Medicine, Tameside General Hospital, Lancashire, United Kingdom

ABSTRACT

Although tuberculosis-related to sudden death is a recognized complication of tuberculosis, it is rarely reported in the literature of the Middle East. A rare case of tuberculosis-related to sudden death is presented here for a 28-year-old Saudi woman who was admitted to our hospital for pulmonary tuberculosis. Although anti-tuberculosis medication was started, she died suddenly; 7 days later, most probably due to a massive haemoptysis. The literature on tuberculosis-related to sudden death in relation to the current case have been reviewed and discussed in this report.

Keywords: Tuberculosis, Sudden death, Massive haemoptysis

Address for Correspondence:

DR. ABDULHAKEEM O. AL THAQAFI
Infectious Diseases Section, Department of Medicine
King Abdulaziz Medical City, National Guard Health Affairs
P.O. Box 9515, Jeddah 21423, Saudi Arabia
e-M: thaqafiAO1@ngha.med.sa