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Pulmonary Function Testing in Patients with Abdominal Aortic Aneurysms: An Audit of Safety and Outcomes

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To the Editors:

Abdominal aortic aneurysm (AAA) affects approximately 4–7% of men and 1–2% of women over the age of 65 years.^{2–5} An aneurysm larger than 5 cm carries a high risk of rupture. Aneurysms >5.5 cm diameter in men, and >5.0 cm in women, are at significant risk of rupture and should be considered for repair unless major contraindications exist. Elective surgical repair of aortic aneurysms aims to prevent death from rupture. The pre-operative work-up of patients with AAA, often includes spirometry. However, there is some concern of rupture when performing spirometry, particularly among large (>6cm) aneurysms. An important reason for the persistence of this concern is a lack of data on the safety of spirometry performed in patients with AAA. In an attempt to somewhat improve the situation, we undertook a retrospective observational cohort study of patients who had undergone pre-operative pulmonary function testing for infra-renal non-ruptured AAA between October 2008- March 2014 in our institution (Gold Coast Hospitals and Health Services, Queensland, Australia). Patients were enrolled in the study if the pulmonary function test request specified that it was being performed in a pre-operative AAA patient. Patients' hard copy medical records and electronic discharge summaries were reviewed. We collected information pertaining to patient demographics (age, gender, smoking status, presence of other co-existing illnesses), characteristics of underlying AAA disease, treatment provided and outcomes (death within 12 months after spirometry). Pulmonary function testing was performed according to the standards of the American Thoracic Society (REF). A spirometer (model and type) was used under the supervision of an accredited respiratory scientist to measure forced expiratory volume in 1 s (FEV1) and forced vital capacity (FVC). FEV1% was defined as FEV1 in relation to predicted normal FEV1 and FVC% as FVC in relation to predicted normal FVC. Chronic obstructive pulmonary disease (COPD) was present if FEV1/FVC < 70% and the Global Initiative for Chronic Obstructive Lung Diseases (GOLD) guidelines was used to grade (stage) the severity of obstructive lung disease. The study was approved by the Gold Coast Health Service District Human Research Ethics Committee (HREC/13/QGC/129). All statistical analyses were performed using Statistical Product and Service Solutions

(SPSS) Statistics version 20.0 (SPSS, Chicago, IL, USA). Normally distributed data is presented as mean and standard error and non-parametrically distributed data is presented as median and range.

We identified 56 patients who had undergone pulmonary function testing during their AAA pre-operative work-up. Median age was 73 years (range: 55- 83), and 8 (14%) were women. Most patients were overweight with a median body mass index (BMI) of 27kg/m² (range 20-38). In the study cohort, the median size of the AAA was 6cm (range 5 – 13cm). The prevalence of chronic kidney disease, hypertension, ischaemic heart disease, anaemia, diabetes mellitus and cerebrovascular disease among the study patients was 77%, 66%, 30%, 27%, 16% and 9% respectively. At the time of the pulmonary function test, 54% of patients were documented to be former smokers, 32% were current smokers and smoking status was not documented for the remaining 14% of patients.

Spirometry was performed in all 56 patients, diffusion capacity measurements were performed in 29 (52%) patients and lung volumes were measured in 26 (46%) patients. COPD was found in 43 (77%) patients, among whom 20 (36%) patients had mild, 15 (27%) patients had moderate and 8 (14%) patients had severe disease. Importantly, there were no reported early or late complications following pulmonary function testing. Three patients declined to perform test manoeuvres to measure lung volumes because of concern about size of their AAA. Among these patients, the size of the AAA was 7cm in two patients and 5.5cm in one patient. 45 (80%) patients underwent operative intervention for the AAA (open AAA repair in 29 patients; endovascular aneurysm repair in 16 patients). The median time between a patient performing pulmonary function tests and undergoing operative intervention for the AAA was 41 days (range 3 – 353 days). At the time of conclusion of this study, 7 (13%) had died and the median time of the death since performing pulmonary function testing was 138 days (range 60-1286 days). Among the 7 patients who died, 3 patients had surgical intervention for the AAA and died within 30 days of surgery due to post-operative complications, while the remaining four patients had not undergone any surgical intervention.

Competing interests

The authors declare that have no competing interests.

Authors' contributions

DZ designed the study, conducted literature reviews and drafted the manuscript. DZ and JW collected the data. KBS conducted literature reviews, analysed the data and helped to draft the manuscript. All authors read and approved the final manuscript.

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Table 1: Patient Characteristics and comparison of lung function test and common risk factors in relation to survival at one year after spirometry

General Characteristics	Survivors	Non-survivors	p-value
Age (years)			
Gender (female), n (%)			
Current smoker, n (%)			
BMI (kg/m ²), (mean±SD)			
Spirometry, (mean±SD)			
FEV1 (%)			
FVC (%)			
FEV1/FVC			
COPD Classification, n (%)			
Mild			
Moderate			
Severe			
Very severe			
Co-morbidities, n (%)			
Hypertension			
Ischaemic Heart Disease			
Diabetes Mellitus			
Cerebrovascular Disease			
Stage 3 CKD			
Anaemia			
Size of AAA			
<5.5cm			
>5.5cm			
Management			
Open AAA repair			
EVAR			
Conservative			

Table 2: Spirometry complications and patient reported limitations

	Patients, n (%)
No complications or limitations	47 (84%)
Premature termination of spirometry due to concern about size of AAA	3 (5)
Patient reported difficulty understanding and/or complying with spirometry technique	2 (4)
Coughing during spirometry	3 (5)
Glottic closure	1 (2)