An increasingly breathless patient

Sir,

We read the recent article by Karkhanis and colleagues entitled “Flow volume loops as a diagnostic marker” with great interest. The authors describe the case of a young girl who developed exertional dyspnea after a period of mechanical ventilation. Flow-volume loops demonstrated a “box-pattern” suggesting fixed upper airways obstruction. Subsequently, the diagnosis of post-intubation tracheal stenosis was made. We would like to present another case of fixed upper airway obstruction, of a different etiology, reinforcing the importance of the use of simple flow-volume loops.

A 56-year-old male attended a respiratory clinic appointment for follow-up of a suspected lower respiratory tract infection (LRTI) 6 weeks previously for which he had been admitted to our Medical Assessment Unit. The patient had initially been admitted with complaints of breathlessness and dry cough for the preceding 2 weeks associated with a degree of chest tightness. D-dimer assay performed on his first admission was negative and his chest X-ray [Figure 1] was unremarkable. The presumptive diagnosis of LRTI was made in view of a raised C-reactive protein of 41 mg/L and the patient discharged on antibiotics. Since that time, the patient’s symptoms had not improved, and had in fact gradually worsened when reviewed in the respiratory clinic 6 weeks later. The patient described marked breathlessness that had been present for 2 or 3 months only; he had had no symptoms before this time. He did not report any expectoration, hemoptysis, orthopnea, ankle edema or any systemic symptoms. A small goitre was apparent, which the patient reported having noticed for the previous few weeks, but no stridor was audible at this time. Otherwise, the general physical and systemic examination was unremarkable. A simple spirometry performed in the clinic demonstrated an FEV₁/FVC ratio of 64% and an FEV₁ that was 73% predicted. The peak expiratory flow rate was 290 L/min (56% predicted). The disproportionate decrease in peak expiratory flow as compared with the FEV₁ in conjunction with the clinical history raised a suspicion of upper airway obstruction. Flow-volume loops and a computed tomography (CT) scan were organized. The flow-volume loop demonstrated flattened inspiratory and expiratory curves consistent with fixed extrathoracic airway obstruction. Empey’s index and midvital capacity ratios were also in keeping [Figure 2 and Table 1]. The CT scan demonstrated marked compression of the trachea in the lower neck due to an enlarged thyroid. At its narrowest point, the trachea measured just 0.6 × 1.2 cm in diameter [Figure 3]. A left thyroid lobectomy was subsequently performed, which resulted in prompt amelioration of his breathlessness. Histology subsequently was consistent with a diagnosis of follicular carcinoma of the thyroid. His case was then referred for discussion at the multi-disciplinary team meeting for further management.

Extrathoracic airway obstruction is an uncommon but not a rare cause of breathlessness. Some of the more prevalent causes of upper airway obstruction that present...
with breathlessness include post-traumatic strictures, bilateral vocal cord paralysis, chronic inflammatory foci and goitres.\cite{2,3} Upper airways obstruction is a well-recognized complication of thyroid disease.\cite{2} In this context, evidence of airway obstruction on flow-volume loops may well be an incidental finding with no clinical implications. Twenty-five percent of patients with large goitres report the symptom of breathlessness.\cite{4} Case series have reported that up to one-third of patients with goitres have upper airway obstruction and that most improve post-thyroidectomy.\cite{2}

The flow-volume loop is a simple non-invasive test and is the best method of evaluating upper airways obstruction and distinguishing it from obstructive pulmonary disease.\cite{4} As discussed by Karkhanis et al., the Empey’s index and ratio of maximal expiratory flow at 50% of vital capacity and maximal inspiratory flow at 50% of the vital capacity (MEF50/MIF50) are also useful indices to help make this diagnosis. A fixed upper airway obstruction will limit maximal flow to the same level regardless of lung volumes.\cite{5} The flow will become lung volume independent apart from the initial period of inspiration and end of expiration, where lower lung volumes exert less traction on the small airways allowing the smaller airways to narrow and become the rate-limiting factor in determining flow.\cite{5} This gives a clipped or “square box” appearance of the flow-volume loop with flow limited equally in both inspiration and expiration. As discussed by Karkhanis et al., variations in this clipping can give a clue as to the cause of upper airway obstruction.\cite{1} In addition, flow-volume loops can provide an estimate of the size of the patent airway by changing the diameter of the mouth piece used until it becomes the rate-limiting component.

However, it should be noted that clinical history predicts obstruction poorly, as exemplified by this case. In one study of patients with large goiters, 29% of patients with goitre symptoms were found to have no airway obstruction on flow-volume loops; conversely, obstruction was demonstrated in 21% of patients with no symptoms.\cite{6} Furthermore, clinical assessment of thyroid size demonstrates no relation to likelihood of airway obstruction.\cite{4} The retrosternal extent of a goitre is not amenable to clinical examination. Imaging techniques such as a CT scan will both confirm and quantify the presence and extent of airway compromise. If the clinical suspicion is not high, appropriate investigations may not be requested and the diagnosis may remain elusive. Upper airway obstruction presenting as breathlessness is uncommon but should be borne in mind by physicians as the diagnosis can be effectively made with the use of flow-volume loops and imaging and symptoms easily ameliorated with correct treatment.

Richard S. Bodington, Shoaib Faruqi\textsuperscript{1}

Hull-York Medical School, University of Hull, Hull, Department of Respiratory Medicine, University of Hull and Hull-York Medical School, Castle Hill Hospital, Cottingham, United Kingdom

E-mail: hy9rb@hyms.ac.uk

REFERENCES
1. Karkhanis VS, Desai U, Joshi JM. Flow volume loop as a diagnostic marker. Lung India 2013;30:166-8.
2. Miller MR, Pincock AC, Oates GD, Wilkinson R, Skene-Smith H. Upper airway obstruction due to goitre: Detection, prevalence and results of surgical management. Q J Med 1990;74:177-88.
3. Brookes GB, Fairfax AJ. Chronic upper airway obstruction: Value of the
Sir,

A 42-year-old Caucasian female with a prolonged history of intravenous (IV) methamphetamine abuse presented with high-grade fever, progressively worsening productive cough, dyspnea, myalgia, arthralgia and intermittent confusion for 1 week. The initial laboratory assessment showed leukocytosis, thrombocytopenia, and acute kidney injury. Chest X-ray showed bilateral lower lobe consolidation with small cavities surrounded by focal infiltrates in the right lung [Figure 1]. Computed tomography of the chest confirmed the presence of multiple cavitary pulmonary nodules suggestive of septic embolization [Figure 2]. Because of a high index of suspicion for infective endocarditis, a transthoracic echocardiogram was obtained, which showed a 3.6 cm × 2.6 cm vegetation on the tricuspid valve and 2.5 cm × 1.6 cm vegetation on the tricuspid annulus, accompanied by severe tricuspid regurgitation. Trans-esophageal echocardiogram demonstrated multiple, large multilobulated, mobile vegetation on the tricuspid valve, with the largest being 3.7 cm × 2.5 cm in size [Figure 3]. Blood cultures were positive for methicillin-resistant *Staphylococcus aureus*.

The patient was initially treated with vancomycin and ceftriaxone. However, the patient failed to improve clinically and, eventually, underwent tricuspid valve excision, right ventricle/tricuspid valve debridement and tricuspid valve replacement. The post-operative course was uneventful and the patient made a satisfactory recovery.

Septic pulmonary embolism (SPE) is a rare and serious disorder that usually presents with non-specific clinical features including fever, pulmonary symptoms and peripheral nodular lung infiltrates with or without cavitation. [1,2] Major risk factors are IV drug abuse, indwelling catheters, tricuspid valve endocarditis, head and neck infections and immunocompromised state. Early diagnosis of the infectious source and appropriate use of anti-microbial therapy is critical in the management because untreated SPE can lead to

---

4. Gittoes NJ, Miller MR, Daykin J, Sheppard MC, Franklyn JA. Upper airways obstruction in 153 consecutive patients presenting with thyroid enlargement. BMJ 1996;312:484.

5. Chapman S, Robinson G, Stradling J, West S. Oxford Handbook of Respiratory Medicine. (2nd Ed.): Oxford University Press New York.;2009. p. 829-9.

6. Cooper JC, Nakielny R, Talbot CH. The use of computed tomography in the evaluation of large multinodular goitres. Ann R Coll Surg Engl 1991;73:32-5.