The use of new ‘Forced oscillation technique (FOT)’ in assessment and stratification of disease severity in elderly COPD patients


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Introduction
Performing lung function test is difficult in elderly COPD patients. This is because traditional lung function is time consuming and it requires subjects to have good coordination and doing the forced expiration maneuver well.

Forced oscillation technique (FOT) may be an important tool for assessing elderly COPD patients. FOT is a new lung function measurement technique with advantage of quick acquisition of data. It requires minimal patient manipulation and the whole test can be completed in 10 seconds. However, up to now, there are very limited studies on the use of FOT in COPD patients.

Aim
1) To evaluate the accuracy of FOT in assessing the severity of elderly COPD patients.
2) To determine cut-off value of FOT parameter to identify severe patient group (%FEV1<50% predicted).

Methods
Stable spirometry-confirmed COPD subjects were recruited from Kwong Wah Hospital, from Jan 2010 to Jan 2011. The severity of each patient was first indicated by the ‘GOLD stage’ according to their %FEV1. Lung function tests were done by using traditional spirometry as well as new FOT machine MedGraphics Chest MT (2n) in the same visit. The GOLD stage was then compared with FOT parameters including frequency resonance (fRes), frequency dependency (fDep), average resistance (Rav), average resistance (Dav) and resistance at 6Hz (R6Hz). ROC curve was plotted to determine the cut-off point of FOT for identifying the ‘severe’ COPD group (defined as %FEV1 < 50% predicted).

Results
Totally, 106 COPD patients (93.1% male) with a mean age of 70.6±8.3 and median GOLD stage of 2 were recruited. FOT parameters showed very good correlation with GOLD stages. Among the different FOT parameters, fRes, fDep were the best predictor for the disease severity. (ANOVA test, p<0.001) (Fig. 1 and table 1)

A cut-off value of fRes=29 has a sensitivity of 71%, sensitivity of 65%, from under curve (AUC) value 0.77 in identifying severe COPD patients (%FEV1<50% predicted). (Fig. 2)

Table 1. Correlation between GOLD stages and different FOT parameters

<table>
<thead>
<tr>
<th>GOLD stage</th>
<th>fRes</th>
<th>fDep</th>
<th>Rav</th>
<th>XAvr</th>
<th>R6Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>GOLD stage 1</td>
<td>13.5±4.40</td>
<td>0.019±0.049</td>
<td>3.01±0.830</td>
<td>0.45±0.94</td>
<td>3.2±1.19</td>
</tr>
<tr>
<td>GOLD stage 2</td>
<td>25.93±8.25</td>
<td>0.058±0.042</td>
<td>3.25±0.97</td>
<td>1.0±0.8</td>
<td>3.87±1.2</td>
</tr>
<tr>
<td>GOLD stage 3</td>
<td>31.88±7.87</td>
<td>0.099±0.056</td>
<td>3.04±1.09</td>
<td>1.5±1.15</td>
<td>3.99±1.63</td>
</tr>
<tr>
<td>GOLD stage 4</td>
<td>33.30±6.45</td>
<td>0.114±0.062</td>
<td>3.03±1.46</td>
<td>1.74±1.17</td>
<td>4.15±1.83</td>
</tr>
<tr>
<td>P value</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>0.779</td>
<td>0.003</td>
<td>0.382</td>
</tr>
</tbody>
</table>

Fig. 1a: fRes in different GOLD stages
Fig. 1b: fDep in different GOLD stages
Fig. 2: ROC curve for using fRes in diagnosis of severe COPD patient (%FEV1<50% predicted)

Conclusion
FOT is an accurate and cost-effective technique for assessment of disease severity in elderly COPD patients. fRes and fDep correlate best with the GOLD stages. A cut-off value of fRes=29 shows fairly well sensitivity and specificity in identifying severe COPD patients.