Randomised crossover study of the Flutter device and the active cycle of breathing technique in non-cystic fibrosis bronchiectasis

C S Thompson, S Harrison, J Ashley, K Day, D L Smith

Thorax 2002; 57:446–448

Background: Airway clearance techniques are an important part of the routine care of patients with bronchiectasis. The use of the Flutter, a hand held pipe-like device causing oscillating positive expiratory pressure within the airways, has been proposed as an alternative to more conventional airway clearance techniques.

Methods: A randomised crossover study was performed in 17 stable patients with non-cystic fibrosis bronchiectasis at home, in which 4 weeks of daily active cycle of breathing technique (ACBT) were compared with 4 weeks of daily physiotherapy with the Flutter device.

Results: No significant differences between the two techniques were found. Median weekly sputum weights were similar with a median treatment difference of 7.64 g (p=0.77) and there was no evidence of treatment order or order interaction effects (p=0.70). Health status (Chronic Respiratory Disease Questionnaire) and ventilatory function did not change significantly during either treatment period. There was no significant change in peak expiratory flow rate or in breathlessness (Borg score) after individual physiotherapy sessions with either technique. A questionnaire indicated subjectively that patients preferred the Flutter (11/17) to ACBT for routine use.

Conclusions: Daily use of the Flutter device in the home is as effective as ACBT in patients with non-cystic fibrosis bronchiectasis and has a high level of patient acceptability.

Airway clearance techniques such as chest physiotherapy remain an important part of treatment in bronchiectasis, together with prompt antibiotic treatment for infective exacerbations. Interest has been generated in the Flutter device (Varioraw SARL, Scandinavian Inc, Birmingham, Alabama, USA), an alternative to more conventional techniques, which has been tried in a number of respiratory diseases with chronic sputum production including cystic fibrosis (CF), chronic obstructive pulmonary disease (COPD), asthma, and diffuse panbronchiolitis. The Flutter is a simple hand held pipe-like device (fig 1) which produces an oscillating pressure wave through the repeated displacement of a steel ball within a cone. The oscillating positive expiratory pressure is reported to prevent premature closure of the bronchi, to loosen secretions, and allows mobilisation of sputum which may be cleared by the forced expiratory technique (FET). It is not available on prescription in the UK and costs approximately £45.00.

The current literature on the efficacy of the Flutter is limited and studies of its use in bronchiectasis have been in patients with CF. A randomised crossover study of patients with stable CF compared 4 weeks of treatment with the Flutter with autogenic drainage. No differences were found in sputum weight or lung function after a single session with either method at the end of the treatment period, but sputum viscosity was significantly reduced with the Flutter. Konstan et al reported that up to three times more sputum was produced with the Flutter than with postural drainage in similar subjects. In contrast, again in patients with stable CF, Pryor et al found that significantly more sputum was produced with the active cycle of breathing technique (ACBT) than with the Flutter in individual supervised sessions, but similar sputum weights were produced with both methods over 24 hours. Two studies compared the Flutter with percussion, vibration, and postural drainage by a physiotherapist in children with CF admitted to hospital with an acute exacerbation and found no significant differences in lung function or exercise tolerance.

Most studies are short with physiotherapist supervision in hospitalised patients. Comparisons have been made between sputum produced from individual physiotherapy sessions rather than total daily production over several days. One study of more than a year in children with CF compared the Flutter with the positive expiratory pressure mask and found a greater decline in forced vital capacity (FVC), increased hospital admissions, and increased antibiotic use with the Flutter.

Different airway clearance techniques used for comparison with the Flutter, inconsistencies in its application, and various outcome measures all contribute to the difficulties in interpreting the literature. The physiological properties of sputum differ in CF and non-CF bronchiectasis, so different airway clearance techniques may vary in their efficacy.

To our knowledge there are no comparative studies with the Flutter device in patients with non-CF bronchiectasis. We have performed a study in such patients at home, comparing the efficacy of the Flutter with ACBT.

METHODS
Study design
ACBT and the Flutter were used unassisted at home for 4 weeks in a randomised crossover design. Patients with productive bronchiectasis attending a specialist respiratory outpatient...
The Flutter device in non-cystic fibrosis bronchiectasis

Table 1  Baseline characteristics and treatment differences between 4 weeks of treatment with the Flutter and 4 weeks of ACBT

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline characteristics</th>
<th>Difference (95% CI) (n=17)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flutter first (n=13)</td>
<td>ACBT first (n=9)</td>
<td></td>
</tr>
<tr>
<td>Age (years) *</td>
<td>59 (8)</td>
<td>68 (16)</td>
<td>–</td>
</tr>
<tr>
<td>Sex, male [%]</td>
<td>5 (38)</td>
<td>3 (33)</td>
<td>–</td>
</tr>
<tr>
<td>Percentage predicted FEV₁*</td>
<td>0.67 (0.38)</td>
<td>0.70 (0.42)</td>
<td>–</td>
</tr>
<tr>
<td>Percentage predicted FVC*</td>
<td>0.73 (0.31)</td>
<td>0.83 (0.23)</td>
<td>–</td>
</tr>
<tr>
<td>Percentage predicted PEFR*</td>
<td>0.90 (0.21)</td>
<td>0.86 (0.35)</td>
<td>–</td>
</tr>
<tr>
<td>Sputum weight over 4 weeks (g)*</td>
<td>1.40 (0.105)</td>
<td>1.60 (0.105)</td>
<td>7.64</td>
</tr>
<tr>
<td>Post bronchodilator FEV₁ (l)</td>
<td>2.10 (1.15)</td>
<td>2.55 (1.00)</td>
<td>0.11 (–0.19 to 0.24)</td>
</tr>
<tr>
<td>Post bronchodilator FVC (l)</td>
<td>350 (180)</td>
<td>340 (120)</td>
<td>7.70 (–9.73 to 25.13)</td>
</tr>
<tr>
<td>Borg Total‡</td>
<td>4.44 (0.94)</td>
<td>4.01 (1.19)</td>
<td>–0.09 (–0.37 to 0.19)</td>
</tr>
<tr>
<td>Borg Dyspnoea†</td>
<td>3.87 (1.15)</td>
<td>3.51 (1.28)</td>
<td>0.01 (–0.49 to 0.51)</td>
</tr>
<tr>
<td>Borg Fatigue†</td>
<td>4.25 (1.44)</td>
<td>3.44 (1.60)</td>
<td>–0.19 (–0.82 to 0.45)</td>
</tr>
<tr>
<td>Borg Mastery†</td>
<td>4.84 (0.98)</td>
<td>5.00 (1.24)</td>
<td>–0.10 (–0.65 to 0.46)</td>
</tr>
<tr>
<td>Borg Emotional Function†</td>
<td>4.39 (0.92)</td>
<td>4.11 (1.31)</td>
<td>–0.06 (–0.63 to 0.52)</td>
</tr>
<tr>
<td>PEFR difference before – after morning session*</td>
<td>–</td>
<td>–</td>
<td>–2.50</td>
</tr>
<tr>
<td>PEFR difference before – after evening session*</td>
<td>–</td>
<td>–</td>
<td>–2.72 (–6.95 to 1.52)</td>
</tr>
<tr>
<td>Borg difference before – after morning session†</td>
<td>–</td>
<td>–</td>
<td>0.13 (–0.08 to 0.34)</td>
</tr>
<tr>
<td>Borg difference before – after evening session*</td>
<td>–</td>
<td>–</td>
<td>–0.04</td>
</tr>
</tbody>
</table>

ACBT = active cycle of breathing technique; FEV₁ = forced expiratory volume in 1 second; FVC = forced vital capacity; PEFR = peak expiratory flow rate; CRQ = Chronic Respiratory Disease Questionnaire; Borg scale = Borg dyspnoea scale. Values are mean (SD) and mean difference (95% confidence intervals) unless otherwise stated. *p values are obtained using the t test for normally distributed data and Wilcoxon rank sum tests otherwise. †Median (IQR) values; ‡seven in Flutter arm followed by ACBT, eight in ACBT arm followed by Flutter.

in health status. In addition, for each outcome, tests were performed for a treatment effect, an order effect, and for order interaction. Bonferroni corrections were applied as appropriate. A p value of <0.05 was considered statistically significant.

RESULTS
Five of the 22 patients recruited to the study were withdrawn. All five used the Flutter first; three dropped out because of an infective exacerbation (two during the Flutter arm and one during the ACBT arm) and two recorded insufficient data for analysis. Baseline characteristics for all who entered the study are shown in table 1.

The diagnosis of bronchiectasis had been confirmed by prior CT scanning (14/17) or bronchography (3/17). None had CF; the underlying aetiology of the bronchiectasis was unknown in six cases, post-pneumonic in four, post-whopping cough in six, and one was associated with inflammatory bowel disease.

There was no significant difference between the ACBT and Flutter for any outcome (table 1), nor was there evidence to suggest any treatment order or interaction effect (p>0.1). Median (IQR) daily sputum weights were 26.6 g (15.0–45.2) for ACBT and 23.4 g (16.8–36.2) for the Flutter (p=0.05). There was a statistically significant improvement in FEV₁ with the Flutter, but this did not achieve a clinically meaningful change. The mean (SE) total time spent each day performing the airway clearance techniques was similar (29.5 (17.0) minutes and 25.9 (11.7) minutes for the ACBT and Flutter, respectively; p>0.05). Eleven of the 17 patients preferred the Flutter for routine daily use, three preferred ACBT, and three had no preference. One patient reported nausea using the Flutter; no other adverse events occurred.

DISCUSSION
This study shows that the Flutter is as effective in aiding sputum clearance in patients with non-CF bronchiectasis as the ACBT. Previous studies have frequently been performed in hospital with supervision from a physiotherapist and over a shorter time varying from a single physiotherapy session1 to a few days.1 14 Our study confirms the efficacy of the device when used unsupervised by the patient in the home over a period of
1 month. Many earlier studies did not include comparison with the now widely accepted ACBT, nor did they include FET with the Flutter, and this may explain why we have found the technique to be effective where others have not. Ventilatory function, sputum production, and health related quality of life are not the only important outcome measures; exercise capacity, use of medication, the number and duration of infective exacerbations, and cost effectiveness are other parameters not addressed by our study which could be incorporated into a future study over a longer period.

The Flutter was well tolerated; there were no adverse events with either technique, although one patient reported nausea after using the Flutter and a pneumothorax has been reported in the literature in a patient with panbronchiolitis. Like others, we have found the Flutter to have a high level of patient acceptability; 11 of the 17 patients preferred the Flutter for routine use and its ease of use was commented upon.

A recent review of airway clearance techniques in adults has suggested that, if the objective differences are small between the different techniques, then individual preferences are likely to play an important part in compliance with treatment. We have found the Flutter to be as effective as the ACBT in the home in a group of patients with non-CF bronchiectasis and therefore suggest that individuals with bronchiectasis should be offered a trial of the Flutter and, if preferred by them, it should be recommended for regular daily use.

ACKNOWLEDGEMENTS

The authors acknowledge the Medical Illustration Department, K Parry and Dr C Rogers, Research and Development Unit, North Bristol NHS Trust.

Authors’ affiliations

C S Thompson, S Harrison, J Ashley, K Day, D L Smith, Department of Medicine, Frenchay Hospital, Bristol BS16 1LE, UK

Funded by Frenchay Respiratory Research Fund.

Conflict of interest: none.

REFERENCES

Randomised crossover study of the Flutter device and the active cycle of breathing technique in non-cystic fibrosis bronchiectasis

C S Thompson, S Harrison, J Ashley, K Day and D L Smith

Thorax 2002 57: 446-448
doi: 10.1136/thorax.57.5.446

Updated information and services can be found at:
http://thorax.bmj.com/content/57/5/446

These include:

References
This article cites 15 articles, 1 of which you can access for free at:
http://thorax.bmj.com/content/57/5/446#BIBL

Email alerting service
Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Topic Collections
Articles on similar topics can be found in the following collections
Sports and exercise medicine (92)
Airway biology (1100)
Lung function (773)

Notes

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/