# Factors influencing the single breath carbon monoxide transfer coefficient in asthma and bronchiectasis

**Jamalul Azizi Abdul Rahman, Neil Misso and Philip Thompson**

**Asthma & Allergy Research Institute, The University of Western Australia,**
**Sir Charles Gairdner Hospital, Nedlands, Western Australia**

## Introduction

e single-breath carbon monoxide transfer factor or diffusing capacity ($D_{LCO}$) measures carbon noxide uptake during breath holding at total lung capacity.

o can be normalised for the alveolar volume ($V_A$) and this adjusted value is designated as the nsfer coefficient, $K_{CO}$ or $D_{LCO}/V_A$.

o measures the ability of the lungs to transfer inspired oxygen to the blood through the pulmonary culature.

o depends on the diffusing capacity of the alveolar/capillary membranes, the rate of reaction of CO h haemoglobin and on the pulmonary capillary volume.

ough an early study showed a reduction in $D_{LCO}$ in asthma, subsequent studies have generally wn that $D_{LCO}$ and/or $K_{CO}$ are either normal or raised in asthma.

e asthma, bronchiectasis is characterised by airway obstruction and inflammation of the airways, permanent dilatation of the bronchi and bronchioles is a feature of bronchiectasis not found in hma.

e is known about factors that might influence $D_{LCO}$ and $K_{CO}$ in bronchiectasis. However, similar tors including airway inflammation and the degree of airway obstruction may influence $K_{CO}$ in hma and bronchiectasis.

## Aim

compare $K_{CO}$, $D_{LCO}$ and other lung function parameters as well as atopy and smoking status, body s index (BMI) and duration of disease in carefully characterised groups of patients with asthma or chiectasis

## Methods

**design**

vas a retrospective review of the patient records of a cohort of outpatients with stable asthma 1) or bronchiectasis that was not due to allergic bronchopulmonary aspergillosis (n=30).

tients had undergone at least one detailed respiratory function test in the previous twenty years and managed by a single respiratory physician.

ion criteria included a history of asthma as defined by the NIH guidelines, or bronchiectasis as osed by clinical examination and high resolution CT scan or chest X-ray.

and FVC were measured by spirometry. TLC, VC and RV were measured by the plethysmograph que or, if that was not feasible, by the helium dilution technique.

tandard single breath technique was used to measure $D_{LCO}$, $V_A$ and $K_{CO} = D_{LCO}/V_A$. $D_{LCO}$ and $K_{CO}$ expressed as % predicted values and normal limits for $K_{CO}$ were defined as predicted ± 1 SD.

ther data recorded for each patient included gender, age, BMI, duration of disease, atopic status, ng status and pack years smoked.

ata for patients who had two or more pulmonary function tests over a period ≥ 2 years was used for udinal analyses.

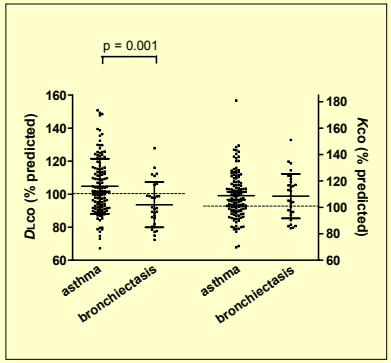
were analysed using unpaired t-tests, Pearson's correlation and multiple regression. In patients for longitudinal measurements of $K_{CO}$ were available, the change in $K_{CO}$ over time was assessed by

## Results

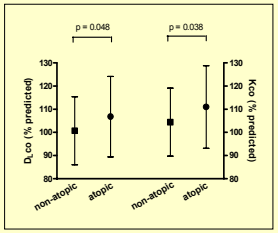
Characteristics of Patients With Asthma or Bronchiectasis

| | Asthma | Bronchiectasis | Significance |
|---|---|---|---|
| Number | 131 | 30 | |
| Females (%) | 71 (54.2) | 26 (86.7) | p = 0.001 |
| Age (SD) | 51.5 (15) | 58 (12.9) | p = 0.03 |
| BMI (SD) | 27.4 (5.2) | 24.7 (4.7) | p < 0.05 |
| Atopic (%) | 88 (67.2) | 8 (26.7) | p < 0.05 |
| Non-smokers (%) | 71 (54.2) | 20 (66.7) | NS |
| Ex-smokers (%) | 48 (36.6) | 9 (30) | NS |
| Smokers (%) | 12 (9.2) | 1 (3.3) | NS |
| Duration of Disease (years, SD) | 16.7 (15.6) | 20.6 (18.3) | NS |
| $FEV_1$ (% pred, SD) | 87 (21.7) | 86.1 (17.2) | NS |
| $FEV_1$/FVC% (mean, SD) | 67.3 (12.7) | 70.6 (7.6) | NS |
| RV (% pred, SD) | 124.1 (36) | 126.6 (32.5) | NS |

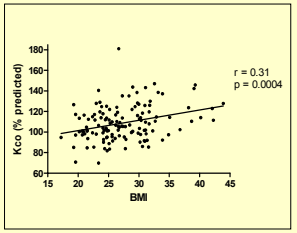
$D_{LCO}$ and $K_{CO}$ in Asthma and Bronchiectasis



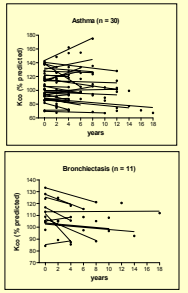

$D_{LCO}$ and $K_{CO}$ in atopic and non-atopic asthmatic patients




Correlation between $K_{CO}$ and BMI in asthmatic patients




Change in $K_{CO}$ over time




There was a small overall decrease in Kco with time i asthma (mean slope, -0.32 0.33). The decrease was greater in bronchiectasis (mean slope, -1.39 ± 0.58), the difference was not statistically significant (p =

## Summary

- Mean $D_{LCO}$ was significantly greater in asthma than in bronchiectasis, but mean $K_{CO}$ did not differ between the two groups.
- $K_{CO}$ was above normal ( > 100% of predicted ) in 90 (68.7%) asthma patients and 20 (66.7%) bronchiectasis patients.
- Mean $K_{CO}$ was significantly elevated in asthma (108.8 ±17.1% of predicted, p<0.001) and in bronchiectasis (108.5 ± 16.9% of predicted, p=0.01).
- There was no correlation between % predicted $K_{CO}$ and $FEV_1$/FVC in either asthma or bronchiectasis patients.
- In asthma but not bronchiectasis, $K_{CO}$ and $D_{LCO}$ were increased in atopic patients and $K_{CO}$ was positively correlated with BMI.
- In asthma and bronchiectasis, $K_{CO}$ was not influenced by smoking status.
- Multiple regression analyses that included age, gender, smoking status and lung function, showed that increased BMI (p = 0.001) and being atopic (p = 0.02) were independently correlated with increased % predicted $K_{CO}$ in asthma, but not in bronchiectasis.

## Conclusions

- Airway obstruction does not appear to be associated with alter gas transfer in asthma or bronchiectasis.
- A reduction in alveolar volumes may contribute to the elevated in bronchiectasis.
- In asthma, however, the elevation in $K_{CO}$ appears to be associ with other factors such as atopy and increased BMI.
- Atopy may be associated with increased airway inflammation, increased BMI may result in increased lung volumes.
- Both airway inflammation and increased BMI may contribute to increase in pulmonary capillary volume and thereby an increas $K_{CO}$ above predicted values.
- In contrast with emphysema patients, $D_{LCO}$ and $K_{CO}$ are not re in asthmatic patients who are current or ex-smokers, suggestin