Relationship between asthma severity and progression of Alzheimer’s disease

Severity of asthma is occasionally modulated by neuropsychiatric conditions.1 However, little is known about the impact of cognitive decline on asthma severity. Cognitive decline is a core symptom in patients with Alzheimer’s disease (AD).2 AD is a disease characterised by progressive cholinergic failure3 that could possibly reduce airway hyperresponsiveness to cholinergic stimulation and thus symptoms of asthma. Furthermore, the functions of T lymphocytes—which play a crucial role in the development of chronic asthma—are partially impaired in patients with AD related diseases.4 We hypothesised that declining cognitive function might result in an improvement in asthma, and prospectively studied the contribution of the progression of AD to the clinical course of asthma.

Eight patients with asthma of mean (SE) duration 15.3 (0.9) years from 1995 to 2000. All subjects were treated with oral theophylline (200 mg twice daily) and a 200 μg dose of fenoterol given by a flow driven inhaler as needed. Family members of the patients completed a diary card that recorded asthma symptoms,5 use of daily medication, and the number of hospital admissions for asthma during the 5 years prior to study entry and the 5 year observation period. Cognitive function was assessed by Mini-Mental State Examination (MMSE) and sputum eosinophil counts and methacholine challenge tests6 were performed both at enrolment in the study and at the end. Informed consent was obtained from each patient, his or her family, and an attending physician.

MMSE scores were significantly decreased during the 5 year observation period in all subjects (table 1). Overall attack frequency and severity of asthma symptoms significantly decreased during the progression of cognitive impairment in all but one asthmatic subject with AD (table 1). Induced sputum obtained at the end of the study from seven subjects the minimum cumulative dose of methacholine that induced an increase in respiratory resistance at the end of the study was not significantly different from that obtained at study enrolment (0.426 (0.252) U at end point v 0.368 (0.144) U at enrolment in the study, n=8, p=0.26). No other precipitating factors for asthma were identified during the study period in any subject.

Both overall attack frequency and severity of asthma symptoms decreased significantly during the progression of cognitive impairment in asthma patients with AD. However, peripheral cholinergic function might not be impaired in the airway in patients with AD despite an extensive loss of central cholinergic neurons.3 It has been reported that the nervous system may modulate immunological and inflammatory responses.7 Our results suggest that progression of AD might provide an ameliorating effect on the clinical course of asthma, probably due to alterations in the immunological responses including eosinophilic inflammation in the airway.

T Ohrui, H Arai, M Ichinose, T Matsui, M Yamaya, H Sasaki
Department of Geriatric and Respiratory Medicine, Tohoku University School of Medicine, Sendai 980-8574, Japan

Correspondence to: Dr H Sasaki, Department of Geriatric and Respiratory Medicine, Tohoku University School of Medicine, 1-1 Seiryo-machi, Aoba-ku, Sendai 980-8574, Japan; dept@geriat.med.tohoku.ac.jp

References

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The editors will decide as before whether to also publish it in a future paper issue.

IL-1 haplotypes and lung function decline

We read with interest the paper by Joos et al.1 on the association of IL-1 gene haplotypes with decline in lung function in smokers and share their view on a possible role of IL-1 genetics in inflammatory respiratory diseases. We have analysed the same polymorphism by

Table 1 Assessment of asthma severity and change in cognitive function at study entry (baseline) and 5 year follow up (end point) in asthma patients with Alzheimer’s disease

<table>
<thead>
<tr>
<th>Case</th>
<th>Age (y)</th>
<th>Sex</th>
<th>MMSE score</th>
<th>Asthma symptom score</th>
<th>Daily inhaler puffs</th>
<th>Number of hospital admissions for asthma</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Baseline</td>
<td>End point</td>
<td>Baseline</td>
<td>End point</td>
</tr>
<tr>
<td>1</td>
<td>67</td>
<td>M</td>
<td>23</td>
<td>18</td>
<td>6.4</td>
<td>1.2</td>
</tr>
<tr>
<td>2</td>
<td>66</td>
<td>M</td>
<td>21</td>
<td>16</td>
<td>8.6</td>
<td>2.2</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>F</td>
<td>23</td>
<td>17</td>
<td>10.2</td>
<td>1.6</td>
</tr>
<tr>
<td>4</td>
<td>65</td>
<td>M</td>
<td>22</td>
<td>15</td>
<td>7.8</td>
<td>1.2</td>
</tr>
<tr>
<td>5</td>
<td>65</td>
<td>F</td>
<td>21</td>
<td>16</td>
<td>7.5</td>
<td>0.4</td>
</tr>
<tr>
<td>6</td>
<td>69</td>
<td>F</td>
<td>23</td>
<td>17</td>
<td>9.1</td>
<td>3.6</td>
</tr>
<tr>
<td>7</td>
<td>66</td>
<td>F</td>
<td>22</td>
<td>16</td>
<td>9.2</td>
<td>2.4</td>
</tr>
<tr>
<td>8</td>
<td>68</td>
<td>M</td>
<td>23</td>
<td>21</td>
<td>7.6</td>
<td>7.4</td>
</tr>
<tr>
<td>Mean (SE)</td>
<td>67.0 (0.7)</td>
<td>22.3 (0.3)</td>
<td>17.0 (0.7)*</td>
<td>8.4 (0.5)</td>
<td>1.8 (0.4†)</td>
<td>2.2 (0.3)</td>
</tr>
</tbody>
</table>
the same methods in adult incident non-smoking asthmatic patients and non-smoking controls. Our results indicate that the association of IL-1 genetics with rate of decline in lung function is not limited to smokers.

New adult asthma cases and controls were selected from a cohort of the Mini-Finland Health Survey (MFHS) and later re-evaluated. A more detailed description of the methods used in MFHS has been published elsewhere. The accuracy of the method of asthma case ascertainment has also recently been described. IL-1 haplotypes were found to be significantly associated with the rate of decline of lung function in non-smoking incident cases of asthma (new asthma during follow-up) but not in controls (table 1). The individual haplotypes, Joos et al found that IL1RN A2/IL1B –511T was associated with a rapid decline of lung function in smokers and IL1RN A2/IL1B –511T with a slow decline. In our control group the observed differences were not significant. Surprisingly, in the asthma group the haplotypes had the opposite effects from those in smokers: IL1RN A1/IL1B –511T was associated with a slower decline in lung function and IL1RN A2/IL1B –511T with a more rapid decline. IL1RN A2/IL1B –511T has previously been found to be associated with many inflammatory diseases. The function of these haplotypes would therefore appear to be disease specific.


table 1

<table>
<thead>
<tr>
<th>IL-1 haplotype</th>
<th>(1) IL1RN A2/IL1B –511T</th>
<th>(2) IL1RN A2/IL1B –511C</th>
<th>(3) IL1RN A1/IL1B –511T</th>
<th>(4) IL1RN A1/IL1B –511C</th>
<th>p value*</th>
<th>Post hoc tests between allele groups*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-smoking controls</td>
<td>41.8 [13.8] (n=124)</td>
<td>44.8 [12.3] (n=54)</td>
<td>50.7 [11.2] (n=32)</td>
<td>45.5 [19.4] (n=31)</td>
<td>0.27</td>
<td>Not tested</td>
</tr>
<tr>
<td>Non-smoking new asthma cases</td>
<td>63.2 [24.6] (n=40)</td>
<td>37.7 [20.7] (n=18)</td>
<td>30.9 [16.9] (n=4)</td>
<td>51.0 [24.8] (n=14)</td>
<td>0.0443</td>
<td>3&lt;1, p&lt;0.02</td>
</tr>
</tbody>
</table>

*Two way analysis of variance; T1SD test of means.

Molecular analysis of drug resistant TB

Since the mid 1980s the number of notified cases of TB in the UK has continued to rise with the largest increases noted in London and inner city areas. King George Hospital in Goodmayes, Essex provides clinical services to a population of approximately 230 000; 17% are non-white subjects including immigrants from countries with high rates of M tuberculosis infection and drug resistance. From September 1996 to July 1997 47 adult cases of culture proven TB were identified including seven with drug resistant isolates. None was identified by contact tracing. A previous TB audit of African born patients revealed a high rate of drug resistance (6/24 (25%)) and delays in obtaining drug sensitivities which could have been detrimental to patient management.

Under these circumstances the rapid identification of drug resistance in M tuberculosis isolates would have been helpful. The aim of this study was to determine retrospectively the usefulness of PCR-reverse hybridisation methods for screening for mutations within or adjacent to M tuberculosis genes associated with rifampicin (RIF) and isoniazid (INH, katA, and abpC) resistance. We also determined whether resistance genotyping combined with IS6110 typing could help to identify clusters of drug resistant cases not previously identified by contact tracing.

Seven consecutive drug resistant M tuberculosis culture isolates were analysed for rifampicin and isoniazid resistance and the results were compared with conventional susceptibility testing. The commercially available

References

1 Joos L, McIntyre L, Ruan J, et al. Association of IL-1beta and IL-1 receptor antagonist haplotypes with rate of decline in lung function in smokers. Thorax 2001; 56: 863–6

Authors’ reply

Karjalainen and colleagues present interesting data on the relationship of IL-1β and IL-1 receptor antagonist haplotypes and the rate of decline of lung function in incident asthmatic subjects in a Finnish cohort. We reported that the IL1RN A1/IL1B –511T haplotype was associated with a more rapid decline in lung function in smokers than in the Lung Health Study; in contrast, they found that this same haplotype was associated with a slower rate of decline in lung function in patients with asthma. The authors suggest that this apparent contradiction may be because the function of these haplotypes is disease specific. We agree that a different effect of the same haplotype could occur because of fundamental differences in the pathophysiological processes which cause airflow obstruction in asthma and chronic obstructive pulmonary disease (COPD). In asthma, CD4+ Th2 cells underlie persistent eosinophilic inflammation and remodelling in medium sized and larger airways. In COPD, neutrophils and CD8+ cells appear to play an important role in the airflow limitation by causing proteolytic destruction of peripheral lung parenchyma and fibrous scarring of the small membranous and respiratory bronchioles. Although inflammation appears to be central to both processes, the roles of IL-1β and IL-1 receptor antagonist in these conditions is unknown and it is possible that the polymorphisms that are responsible for these haplotypes do not, by themselves, change the function or level of expression of the IL proteins but are in linkage disequilibrium with a causal polymorphism(s). In this case, the IL1 allelic associations could be different in different populations. The bottleneck in the genetic history of the Finnish people could have established a founder effect and resulted in the function altering allele being found on a different genetic background from that in the white population of the United States.

Whatever the correct explanation, these apparently contradictory results could be due to different genetic histories of the two study groups. Our study group was taken from the white population in the United States whereas Karjalainen et al studied Finnish individuals. It may be that the polymorphisms which are typed to establish these haplotypes do not, by themselves, change the function or level of expression of the IL proteins but are in linkage disequilibrium with a causal polymorphism(s). In this case, the IL1 allelic associations could be different in different populations. The bottleneck in the genetic history of the Finnish people could have established a founder effect and resulted in the function altering allele being found on a different genetic background from that in the white population of the United States.

Whatever the correct explanation, these results support the growing evidence that genetic variation at the IL-1 locus is important in modulating the severity and/or functional consequences of a number of inflammatory conditions.

I Joos, P D Paré, A Sandford

UBC McDonald Research Laboratories and iCAPTURE Center, St Paul’s Hospital, University of British Columbia, Vancouver, BC V6Z 1Y6, Canada; asandford@mf.ubc.ca

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assay INNO-LIPA Rif.TB® was used to detect \textit{rpoB} mutations and an in-house PCR-reverse hybridisation line probe was used to detect mutations in or adjacent to the \textit{katG}, \textit{inhA}, and \textit{ahpC} genes.\textsuperscript{7} The isolates were also IS6110 typed.\textsuperscript{6}

The single rifampicin and isoniazid resistant isolate had an \textit{rpoB} gene mutation associated with rifampicin resistance (table 1). Four of the five isoniazid resistant isolates had the same single point mutation upstream of the \textit{inhA} gene and the other a single \textit{katG} point mutation. Isolates 3 and 5 had indistinguishable IS6110 types that could represent isolates where recent transmission had occurred. No mutations were detected in the 40 fully susceptible isolates.

PCR-reverse hybridisation methods were highly sensitive and specific at detecting mutations that predict for isoniazid and rifampicin resistance. We also demonstrated that different point mutations can be detected to discriminate between isoniazid resistant isolates. We believe that with automation and the addition of oligonucleotide probes designed to detect mutations associated with pyrazinamide (\textit{pncA}) and ethambutol (\textit{embB}) resistance, a system capable of detecting resistance to four front line antituberculous drugs will soon be commercially available. Rapid resistance detection by PCR-reverse hybridisation is likely to have a major impact on patient management and our understanding of the epidemiology of drug resistant TB.

Acknowledgements

We would like to thank the Steering Group Members of the “Molecular Epidemiology of Tuberculosis in London” for allowing us access to their M tuberculosis 15,000 database and to the Mycobacterial Reference Laboratory (Dublin) for conventional susceptibility testing.

M Melzer, T J Brown, G L French
Department of Infection, St Thomas’ Hospital, London SE1 7EH, UK

A Dickens, T D McHugh
Department of Medical Microbiology, Royal Free and University College Medical School, London NW3 2PF, UK

L R Bogg, R A Storning, S Lacey
King George Hospital, Goodmayes, Essex IG3 BY8, UK

References


Lung bullae and marijuana

A previous paper from this hospital described apical lung bullae in four young male marijuana smokers, three West Indian and one Caucasian.\textsuperscript{2} An additional four marijuana smokers were recently reported, both in Caucasian men.\textsuperscript{7} We describe three further cases (one woman) with large upper lobe bullae. All are Caucasian and had a prolonged history of heavy marijuana smoking with an alpha, antitrypsin level within the normal range (table 1). These further cases support the view that marijuana may have a causal role in the development of lung bullae. We suggest that a detailed marijuana smoking history is taken from patients of all ethnic origins with upper lobe bullae.

C S Thompson, R J White
Department of General Medicine, Frenchay Hospital, Bristol BS16 1LE, UK

Correspondence to: Dr C S Thompson, Department of General Medicine, Frenchay Hospital, Bristol BS16 1LE, UK

Pathophysiology of COPD

The paper by Dentener et al\textsuperscript{1} is interesting and contributes to the understanding of the pathophysiology of chronic obstructive pulmonary disease (COPD). It is becoming clear that COPD is a systemic syndrome, and this paper suggests some potential mechanisms. However, a number of issues merit further comment.

It is noted that, in healthy controls, there is a wide range of C reactive protein (CRP) values extending well beyond what would be considered to be the normal range. The reason for this is unclear, but it does suggest that these individuals are not as healthy as described. In addition, patients with stable COPD have a range of CRP values that also extend beyond this normal range. This is not consistent with previous studies, which suggests that, in patients with stable COPD, the range of CRP values falls within the normal range.\textsuperscript{2} Although patients with bronchiectasis were excluded, it is possible that undiagnosed bronchiectasis may have been present. Previous work has shown that 29% of patients presenting with what appeared to be stable COPD had CT evidence of at least mild bronchiectasis.\textsuperscript{3} This could conceivably explain a wider range of CRP levels. In addition, it is interesting that after just 5 days of treatment for an acute exacerbation, the CRP had returned to a level below that of the stable cohort in the study. Since standard treatment for an exacerbation is able to achieve this in just a few days, it suggests that the stable group may have contained individuals that were in fact not so stable.

The authors allude to the potential confounding effect of systemic corticosteroids in the study. The changes in total leucocyte count during the exacerbation are likely to be due to the effect of prednisolone, making it difficult to interpret the changes in leucocyte count. In stable patients the action of corticosteroids may also confound the results. It is possible that, even in patients using inhaled corticosteroids, leucocyte numbers could be affected since there may be significant bioavailability at higher doses. Leucocyte count should therefore not be used as a marker for systemic inflammation in these patients.

Finally, it would appear that the exacerbations of COPD might have been mild, despite the presence of severe COPD on lung function criteria. Although PaO\textsubscript{2} was slightly higher and PaCO\textsubscript{2} slightly lower than in the stable group, these differences were small in magnitude. The pH was not significantly different and, in fact, the stable group contained individuals with a lower pH range (7.30–7.50) than in the exacerbated group (pH 7.34–7.49). Although the mean CRP level appears higher than in stable patients, the range does not differ significantly. This may therefore have led to a less profound change in inflammatory markers than might have been expected, and a study looking at more severe exacerbations may be more revealing.

M Kelly
Department of Respiratory Medicine, Belfast City Hospital, Belfast BT9 7AB, UK, m.kelly@qub.ac.uk

Table: Characteristics at presentation of three cases of apical lung bullae in marijuana smokers

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>33</td>
<td>45</td>
<td>38</td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Ethnic origin</td>
<td>Caucasian</td>
<td>Caucasian</td>
<td>Caucasian</td>
</tr>
<tr>
<td>Tobacco smoking history</td>
<td>9 pack years</td>
<td>10 pack years</td>
<td>20 pack years</td>
</tr>
<tr>
<td>Marijuana smoking history</td>
<td>2–3 joints/day</td>
<td>“heavy” 10 years</td>
<td>“moderate” 10 years</td>
</tr>
<tr>
<td>FEV\textsubscript{1} (normal range)</td>
<td>2.7 (64)</td>
<td>2.4 (96)</td>
<td>3.7 (90)</td>
</tr>
<tr>
<td>FVC (% predicted)</td>
<td>43.8 (35)</td>
<td>3.3 (112)</td>
<td>4.7 (94)</td>
</tr>
<tr>
<td>FEV\textsubscript{1}/FVC (%)</td>
<td>63</td>
<td>73</td>
<td>79</td>
</tr>
<tr>
<td>TCO\textsubscript{2} (predicted)</td>
<td>9.44 (81)</td>
<td>4.99 (62)</td>
<td>–</td>
</tr>
<tr>
<td>KCO (predicted)</td>
<td>1.44 (88)</td>
<td>1.10 (64)</td>
<td>–</td>
</tr>
</tbody>
</table>

FEV\textsubscript{1}, forced expiratory volume in 1 second; FVC, forced vital capacity; TCO\textsubscript{2}, carbon monoxide transfer factor; KCO, carbon monoxide transfer coefficient.
mediators in the circulation. These were used to compare the CRP levels between the groups, as the patients with COPD were considered a healthy population.

Based on these selection criteria, this study (oral or inhaled) was considered a healthy population. Although two of the 23 control patients were excluded in order to prevent bias, the results are not affected by these two outliers.

Concerning the diagnosis of COPD, all patients in our study underwent high-resolution computed tomographic scanning to exclude the presence of bronchiectasis.

There is increasing evidence that COPD is characterised by systemic effects which, among other factors, are reflected by enhanced circulating levels of inflammatory mediators in the circulation. In line with the observations of increased levels of the acute phase proteins CRP and lipopolysaccharide binding protein (LBP) in patients with COPD, which was considered a healthy population, they were not excluded in order to prevent bias. Non-parametric tests were used to compare the CRP levels between controls and COPD patients, and the results are not affected by these two outliers.

We agree with Dr Kelly that treatment with corticosteroids could affect the leucocyte count, as patients diagnosed with COPD have elevated CRP levels on day 1 of the exacerbation which declined during treatment.

Authors’ reply

Dr Kelly has some concerns about the levels of CRP. The patients with clinically stable COPD in our study were in a clinically stable condition in this study and in previous studies by our group, an association between increased plasma levels of the acute phase protein fibrinogen with reduced lung function and increased risk of COPD has recently been reported. The observed increase in leucocyte counts, studies are currently being performed in our hospital in which blood was taken from patients with an exacerbation collected before the start of treatment.

COPD comprises a heterogeneous group of conditions characterised by chronic airflow limitation and destruction of lung parenchyma with clinical manifestations of dyspnoea, cough, sputum production, and impaired exercise tolerance. The definition of an exacerbation of COPD, that is, an increase in symptoms which he/she can manage in their own environment; the patient with a severe exacerbation recognises the need for medication and seeks additional medical assistance; the patient with a moderate exacerbation recognises the need for medication and seeks additional medical assistance; the patient with a severe exacerbation recognises the need for medication and seeks additional medical assistance; the patient with a moderate exacerbation recognises the need for medication and seeks additional medical assistance. The exacerbation of COPD is defined as an increase in symptoms of COPD which he/she can manage in their own environment; patients with a moderate exacerbation have an increased need for medication and need to seek additional medical assistance; the patient with a severe exacerbation recognises the need for medication and seeks additional medical assistance; the patient with a severe exacerbation recognises the need for medication and seeks additional medical assistance; the patient with a severe exacerbation recognises the need for medication and seeks additional medical assistance. The exacerbation of COPD is defined as an increase in symptoms of COPD which he/she can manage in their own environment; patients with a moderate exacerbation have an increased need for medication and need to seek additional medical assistance; the patient with a severe exacerbation recognises the need for medication and seeks additional medical assistance.

References


