Macrolide antibiotics and cystic fibrosis

Do the macrolides have a role in the treatment of cystic fibrosis?

There is growing interest in the potential use of macrolide antibiotics as anti-inflammatory agents in cystic fibrosis. This stems from the dramatic success of long term erythromycin in the treatment of diffuse panbronchiolitis (DPB), a condition with a high prevalence in Japan but rare elsewhere. Clinically, DPB exhibits some similarities to cystic fibrosis including chronic productive cough, exertional dyspnoea, chronic sinusitis, mucoid Pseudomonas aeruginosa colonisation, and bronchiectasis. The introduction of erythromycin as a treatment for DPB has had a dramatic impact on mortality, increasing 10 year survival from 12.4–21.9% to over 90% in those colonised with P aeruginosa. Similar success has been reported with clarithromycin, roxithromycin, and azithromycin. While the aetiology of both conditions may be very different, it is the similarities which are important.

The macrolide antibiotics are an intriguing group of drugs with both anti-inflammatory and antibacterial properties. Their mode of action in DPB is thought to be mediated by mechanisms other than antibacterial as the effect occurs below the minimum inhibitory concentration required for bacteria such as Haemophilus influenzae and P aeruginosa.

There are several theoretical reasons why the macrolides could modulate the disease process in cystic fibrosis. Firstly, airway inflammation, as in DPB, is recognised as a major factor in the pathogenesis of cystic fibrosis lung disease. Anti-inflammatory drugs such as high doses of non-steroidal anti-inflammatory agents and prednisolone have been shown to slow the decline of lung function in patients with cystic fibrosis. Several studies suggest that the macrolides also possess important anti-inflammatory activity which appears to be mediated by an inhibition of neutrophil chemotaxis, reduction of neutrophil elastase, and modification of pro-inflammatory cytokines with suppression of interleukin (IL)-1β, IL-6, IL-8, and tumour necrosis factor (TNF)-α production. Secondly, they reduce sputum viscoelasticity and airway adhesion of P aeruginosa, a mechanism that may be mediated by their ability to disrupt the integrity of the protease protective biofilm and impair the transformation of non-mucoid P aeruginosa to the more virulent mucoid phenotype.

The clinical evidence to support the use of macrolides in the treatment of cystic fibrosis is poor. Most of the studies have only been published in abstract form and are usually anecdotal with small numbers of patients. Frederiksen et al reported a larger randomised, double blind, placebo controlled, crossover study of the effect of twice daily clarithromycin in cystic fibrosis. Various parameters were measured including pulmonary function but, unexpectedly, 20 of 41 patients were excluded from the study so that no conclusions could be drawn. Importantly, failure to complete the study was not related to the active arm.

“Treatment with azithromycin was associated with significantly fewer courses of intravenous antibiotics, maintenance of lung function, reduction in median CRP levels, and improvement in quality of life scores”

In this issue of Thorax Wolter et al report their findings of the first published prospective, randomised, placebo controlled trial investigating the clinical effect of macrolides in the treatment of cystic fibrosis. A total of 49 adults with cystic fibrosis completed the 3 month trial of 250 mg azithromycin versus placebo. Treatment with azithromycin was associated with significantly fewer courses of intravenous antibiotics, maintenance of lung function, reduction in median C reactive protein (CRP) levels, and improvement in quality of life scores. While there was no difference in baseline microbiology, Staphylococcus aureus was isolated from 43.8% of patients at the start of the study. This suggests that some of the clinical response seen in the azithromycin group may have been mediated through the antibacterial activity of the drug. Similar results have been reported in children. In a non-randomised open labelled study Pirzada et al compared the effect of 250 mg azithromycin in 18 children with cystic fibrosis and 18 age and sex matched controls over a mean of 0.78 years. The azithromycin treated group showed significant improvement in lung function and weight gain. The drug was well tolerated and no significant side effects were observed.

In the only other study to be formally published, Jaffe et al reported their findings from an open study of seven children with cystic fibrosis given 250 mg azithromycin for more than 3 months. Although azithromycin was associated with a significant increase in lung function, the results are difficult to interpret. While the study by Wolter et al supports the potential role of macrolides in the treatment of cystic fibrosis, larger double blind, placebo controlled trials are needed which can differentiate between the anti-inflammatory and antibacterial properties of these agents. With the potential ability of the macrolides to alter the complex bacteria/epithelial/biofilm interaction, it is possible that they may have a role both in reducing the incidence of new P aeruginosa colonisation and improving conventional early eradication treatment.

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Psychological factors in asthma control and attack risk

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The risk of asthma episodes may depend on a complex relationship between psychological factors and the experience of a recent attack.

In a series of Australian studies, Yealowices,1 Ruffin,1 and Campbell2 have found high rates of anxiety and panic disorder among patients who have suffered near fatal asthma episodes. In the UK Ayres and coworkers have found a high lifetime prevalence of psychiatric symptoms and psychiatric morbidity in patients with brittle asthma.3,4 Both the Australian studies and that by Ayres et al report a consistent pattern of high levels of denial of asthma and delay in seeking help in acute attacks. The confidential enquiries into asthma deaths5 suggest that psychological factors including denial and delay contribute to some deaths. Patients who had died from asthma were more likely to be those who found it difficult to cooperate with medical management.

However, these studies only refer to a small minority of asthma patients, are post hoc, and may be relevant only to a special group of asthmatic subjects. It is not easy to translate these findings for very severe high risk subjects to moderate asthmatics in general practice.

Anxiety is not always found to be higher among patients with poorly controlled asthma. Barboni et al compared patients with near fatal asthma with a group of matched controls and found no difference in psychiatric anxiety scores between the two groups. Boseley et al6 found no significant difference in anxiety between adherent and non-adherent patients. Some anxiety may be useful in self-management. Spinhoven et al7 found that anxious subjects were more accurate in detecting a fault in forced expiratory volume in 1 second (FEV1) compared with asthmatics who described themselves as having a “bad chest” which resulted in intermittent illness but was not a permanent condition. None of the “deniers” used their prescribed inhaled steroid. Denial was related to seeing asthma as a stigmatised illness and also to seeing themselves as people who could “cope”. To these subjects, acceptance of a self-definition of having asthma and using a preventer regularly would mean that they were “not coping”. Janson and Becker8 prospectively followed 95 patients with asthma and assessed the reasons for the type of action taken when acute episodes occurred. They found that a delay in seeking help was common due to attitudes ranging from fear of steroids to the need to “tough it out”; however, they also found that a small but significant minority identified a pivotal episode in their dealing with acute asthma which changed their attitude to self-management.

The post hoc studies described at the beginning of this article present us with a believable association between denial, psychological morbidity, and a high risk of adverse outcome but they have the limitation of working backwards from a non-representative group. The qualitative studies support the belief that denial and delay are linked to patient willingness to cooperate actively in asthma self-management, but leave unanswered the question of the objective risk of acute episodes associated with different psychological patterns and attitudes to management. Among patients with moderate asthma, are “deniers” more at risk of acute episodes than patients who accept their asthma? In Janson’s study there was any evidence that the patients who described themselves as having a pivotal experience that changed their attitudes to their asthma actually did demonstrate more successful asthma control? Further studies have looked at the prospective consequences of psychological attitudes. In the 1980s Kaptein9 showed...
that patients admitted with asthma who had high anxiety scores were more likely to be re-admitted within 6 months. One recent study by Adams et al in hospital outpatients has shown that the prospective risk of admission was related to greater use of strategies such as “hoping for a miracle” to cure asthma.

In this issue of Thorax the paper by Greaves et al complements the findings by Adams et al and presents new data on how the effect of psychological factors on the risk of asthma episodes may depend on a complex relationship between psychological factors and the experience of a recent attack. We might expect patients who have had recent attacks to have low confidence, a high fear of attack, and a high risk of future attacks. Conversely, we would expect patients who have successfully controlled asthma for more than a year to have low anxiety/fear, high confidence, and a low risk of future attacks. Greaves et al show that the story is not so simple. Past attack experience does not completely explain patient differences in panic fear and confidence, and high confidence in a patient has different implications for the risk of an acute attack depending on whether the patient has a history of well controlled or poorly controlled asthma. They conclude that fear of attack is an important mediator of subsequent asthma and confidence, and high confidence in a patient with well controlled asthma but is good in patients with poorly controlled asthma. Dirks et al found that the most frequent reason patients gave for non-use or intermittent use of inhaled corticosteroids was a belief in their ability to control episodes which is not warranted by their attack history. This is a denial of the need to change their self-management. This overconfidence is likely to be associated with poor compliance and delay in taking action during episodes. Chambers et al found that the majority of patients who gave for non-use or intermittent use of inhaled corticosteroids were unnecessary during non-symptomatic periods. Factors associated with regular use of inhaled steroids were belief about the value of active participation with their doctor in self-care and belief that asthma was a serious health problem.

It would be of value to carry out further studies to determine whether the high confidence/high risk group in the study by Greaves et al is less compliant than the other groups described in the study.

Greaves et al suggest that the period immediately after a serious asthma episode may be a particularly important time for educating and negotiating with patients to change their self-management attitudes and behaviour. This is likely to be of critical importance for overconfident asthma patients who may comprise a significant minority of patients in general practice.

In conclusion, the study by Greaves et al makes clear that recent attack experience is an important mediator of patient behaviour and attitudes to asthma management. Future studies should be mindful of this.

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