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AUDIT UPDATE

Clinical management and outcome of refractory asthma in the UK from the British Thoracic Society Difficult Asthma Registry

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ABSTRACT

Refractory asthma represents a significant unmet clinical need. Data from a national online registry audited clinical outcome in 349 adults with refractory asthma from four UK specialist centres in the British Thoracic Society Difficult Asthma Network. At follow-up, lung function improved, with a reduction in important healthcare outcomes, specifically hospital admission, unscheduled healthcare visits and rescue courses of oral steroids. The most frequent therapeutic intervention was maintenance oral corticosteroids and most steroid sparing agents (apart from omalizumab) demonstrated minimal steroid sparing benefit. A significant unmet clinical need remains in this group, specifically a requirement for therapies which reduce systemic steroid exposure.

BACKGROUND

We have previously published the clinical features of a well characterised group of patients with refractory asthma from specialist UK centres operating established dedicated multidisciplinary assessment protocols and identified important differences between patient groups in individual centres.1 Using the national online registry, we have now audited clinical outcome in 349 of the 582 patients in the original cohort (median follow-up 5.1 years, IQR 1.9–5.5).

RESULTS

There were no differences in baseline demographic variables in the follow-up cohort compared with those lost to follow-up (online supplementary appendix 1).

At follow-up, there was a significant improvement in lung function and a reduction in important healthcare outcomes, specifically hospital admission, unscheduled healthcare visits and rescue courses of oral steroids (table 1). These effects were generally consistent across clinical centres though unscheduled visits were significantly increased in Manchester (online supplementary appendix 2), reflecting the delivery of care at this centre where patients with an increase in symptoms are encouraged to attend the hospital centre.

There was no significant change in dose of inhaled steroid or reported reliever medication use but there was a significant increase in the number of patients prescribed maintenance oral steroids (from 146 (42%) to 199 (57%)). Only five patients (7%) successfully withdrew oral steroids, whereas 78 (22%) were moved onto maintenance oral steroids. There was no significant difference in the dose of oral steroids from baseline to follow-up (16.2±10.4 mg baseline, 15.3±12.8 follow-up).

Consistent with this widespread use of oral steroids, there was a significant reduction in blood eosinophils and increase in body mass index (BMI) (table 1). There was a non-significant trend for the subjects on oral steroids at follow-up to have a lower BMI compared with those not on oral steroids (subjects not on oral steroids 29.5±7.0, subjects on oral steroids 30.9±6.0, p=0.07). However, BMI also increased in patients not on maintenance steroids at follow-up (baseline BMI 28.3±6.8 vs follow-up BMI 29.2±6.9, p<0.001); in this group median rescue steroid exposure was one course of steroids in the preceding 12 months (IQR 0–5).

While blood eosinophils decreased, exhaled nitric oxide paradoxically increased. Because paired fractional exhaled nitric oxide (FeNO) data were only available in a limited number of patients, we examined paired blood eosinophil counts in this subgroup (n=75). The paradoxical fall in blood eosinophils and rise in FeNO were also apparent in this group (eosinophil count in subjects with paired FeNO measurements – baseline eosinophils X 109/litre, median 0.33 (IQR 0.12–0.54) vs follow-up eosinophils, median 0.24 (IQR 0.1–0.4), p=0.001; and baseline FeNO ppb, 47 (IQR 22–69) vs follow-up FeNO, 88 (IQR 76–99), p=0.001).

Steroid sparing strategies (online supplementary appendix 3) and additional therapeutic strategies (online supplementary appendix 4) utilised in this refractory population are shown by centre; therapeutic success was defined by the treating clinician. In general, small numbers of patients were tried on steroid-sparing strategies and few were recorded as clinically beneficial. The use of other interventions was infrequent and variable across clinical centres.

Responders to omalizumab (57 of 59 (68%) based on criteria for the National Health Service Outcomes Drug Reimbursement Scheme, http://guidance.nice.org.uk/TA133/Guidance/doc/English) were more likely to be off oral steroids at clinical follow-up (17 of 57 vs 4 of 22, p=0.031, OR 3.8...
Post-bronchodilator FEV1 %

steroids (OR 1.3 to 3.7), and rescue steroids in the preceding year (OR 2.3, CI 1.0 to 18.2), p < 0.003, Wilcoxon signed rank test) and 8 had an increase in dose (10 mg (7–10 mg), follow-up 12.25 (10–15 mg), p = 0.027, Wilcoxon signed rank test). Of the other 8 subjects whose condition responded to omalizumab only 1 progressed to oral steroids, whereas of those on omalizumab whose condition did not progress, 10 of 12 were on oral steroids at follow-up. Cohorts of different characteristics differed in unscheduled visits, hospital admissions and rescue oral steroids, which taken collectively suggests a reduction in steroid courses. The dissociation between FeNO, clinical outcome and blood eosinophilia is consistent with other data, which have shown that FeNO-based strategies have not been able to reduce exacerbation rates. In a recent oral steroid tapering study, which included FeNO as part of the steroid reduction algorithm, weekly Asthma Control Questionnaire and forced expiratory volume in 1 s measurement were the major drivers of steroid reduction, with minimal contribution from daily FeNO. Collectively, these data question whether FeNO is useful in adjusting steroid dose in patients on maintenance or frequent bursts of oral steroids.

The increase in BMI is also consistent with more steroid exposure, but BMI also increased in subjects not on maintenance oral steroids at follow-up. This latter group remained on high-dose inhaled steroids but rescue steroid exposure in the preceding 12 months was relatively low (median 1, IQR 0–5), suggesting that BMI increase is not exclusively related to oral steroid exposure in this population, and reduced exercise capacity due to persistent asthma may be relevant.

The best predictor of being on oral steroids was being on them at referral, which might initially suggest that specialist services have a minimal effect on maintenance steroid exposure in this patient population. However, this cohort of patients had well phenotyped refractory asthma after detailed systematic evaluation and issues such as incorrect diagnosis, comorbidities and non-adherence have been identified and these subjects excluded. One of the major advantages and benefits of a specialist difficult asthma service is ensuring precise patient characterisation and appropriateness of high-dose asthma therapy in subjects with refractory asthma.

It is unclear why a greater proportion of men were more likely to be on oral steroids at follow-up. Cohorts of difficult and refractory asthma typically include more women, but these data suggest that the requirement for oral steroids, which might be interpreted as one index of severity, is less common in women. Frequency of rescue steroids is also predictive of progression as this identifies someone with steroid-responsive disease prone to exacerbation despite high-dose inhaled therapy. Steroid-sparing strategies (cyclosporin, methotrexate, azathioprine, mycophenolate) are used variably across centres, with Beclometasone dipropionate; FeNO, fractional expiratory nitric oxide; FEV1, forced expiratory volume in 1 s; FVC, forced vital capacity; SABA, short-acting β agonist.

Individual responses also support a steroid-sparing effect—in subjects on maintenance oral steroids pre omalizumab (n=28), 9 withdrew oral steroids completely (baseline dose 20 mg (10–35 mg)), 11 had a steroid dose reduction (baseline dose 20 mg (15–20 mg), follow-up 13 mg (10–15 mg), p = 0.003, Wilcoxon signed rank test) and 8 had an increase in dose (10 mg (7–10 mg), follow-up 12.25 (10–15 mg), p = 0.027, Wilcoxon signed rank test). Of the other 8 subjects whose condition responded to omalizumab only 1 progressed to oral steroids, whereas of those on omalizumab whose condition did not respond, 18 of 22 were on oral steroids at follow-up (15 mg (10–25 mg)).

Using logistic regression, baseline predictors of maintenance oral steroids at follow-up was maintenance oral steroids at baseline (OR 6.5, 95% CI 1.0 to 18.2), χ²(1) = 6 (4–9), 8 (4–10), p = 0.058. Male gender (OR 2.2, 95% CI 1.5 to 3.7), and rescue steroids in the preceding year (OR 2.3, 95% CI 1.1 to 4.9). At follow-up, 84 of 127 men (66%) compared with 115 of 222 women (52%) were on maintenance oral steroids (χ²(1), p < 0.01). The commonest therapeutic strategy was initiation of maintenance steroids, which is consistent with the reduction in peripheral blood eosinophils and the reduction in rescue oral steroid courses. The dissociation between FeNO, clinical outcome and blood eosinophilia is consistent with other data, which have shown that FeNO-based strategies have not been able to reduce exacerbation rates. In a recent oral steroid tapering study, which included FeNO as part of the steroid reduction algorithm, weekly Asthma Control Questionnaire and forced expiratory volume in 1 s measurement were the major drivers of steroid reduction, with minimal contribution from daily FeNO. Collectively, these data question whether FeNO is useful in adjusting steroid dose in patients on maintenance or frequent bursts of oral steroids.

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It is unclear why a greater proportion of men were more likely to be on oral steroids at follow-up. Cohorts of difficult and refractory asthma typically include more women, but these data suggest that the requirement for oral steroids, which might be interpreted as one index of severity, is less common in women. Frequency of rescue steroids is also predictive of progression as this identifies someone with steroid-responsive disease prone to exacerbation despite high-dose inhaled therapy. Steroid-sparing strategies (cyclosporin, methotrexate, azathioprine, mycophenolate) are used variably across centres, with limited clinical success. The low trial rate in some centres reflects the potential side effects of these agents, but additionally our observational data also suggest that the success rate of the most commonly used agents (methotrexate and cyclosporin) is low, which is consistent with the conclusions of recent Cochrane reviews of both methotrexate and cyclosporin.

The only additional therapeutic intervention that demonstrated a steroid-sparing effect was omalizumab. In subjects who received a clinical trial of omalizumab, the overall response rate was 65% and 20% (71%) of the 28 on oral steroids either withdrew or significantly reduced their oral steroid dose.

In summary, this audit demonstrates improved outcomes with reduced exacerbation rates and healthcare utilisation, but at the cost of increased numbers of subjects on systemic steroids.
Steroid-sparing therapies are infrequently used and are only modestly successful in routine clinical practice. In patients who respond to omalizumab, there is the suggestion of a significant steroid-sparing effect in some but not all subjects. There remains a significant unmet clinical need in this group and specifically a requirement for therapies which reduce systemic steroid exposure.

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Contributors LGH is the coordinator of the British Thoracic Society Difficult Asthma Registry and with JS collated and managed the data for this manuscript. CEB and AM-G and RN co-lead the British Thoracic Society Difficult Asthma Network and all have contributed equally to this manuscript.

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Ethics approval Ethics approval was provided by ORECNI.

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REFERENCES