COVID-19 and delivery of difficult asthma services

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ABSTRACT

The COVID-19 pandemic necessitated an urgent reconfiguration of our difficult asthma (DA) service. We rapidly switched to virtual clinics and rolled out home spirometry based on clinical need. From March to August 2020, 110 patients with DA (68% virtually) were seen in clinic, compared with March–August 2019 when 88 patients were seen face-to-face. There was DA clinic cancellation/non-attendance (16% vs 43%; p<0.0003). In patients with home spimeters, acute hospital admissions (6 vs 26; p<0.01) from March to August 2020 were significantly lower compared with the same period in 2019. There was no difference in the number of courses of oral corticosteroids or antibiotics prescribed (47 vs 53; p=0.81). From April to August 2020, 50 patients with DA performed 253 home spirometry measurements, of which 39 demonstrated >20% decrease in forced expiratory volume in 1 s, resulting in new action plans in 87% of these episodes. In our DA cohort, we demonstrate better attendance rates at virtual multidisciplinary team consultations and reduced hospital admission rates when augmented with home spirometry monitoring.

INTRODUCTION

Prior to the COVID-19 pandemic, few studies had investigated the effectiveness of virtual asthma clinics for children.1,2 Due to the pandemic, outpatient face-to-face consultations were suddenly reduced and the majority changed to telephone consultations. We therefore explored new approaches to deliver our difficult asthma (DA) service. We introduced home spirometry, clinical nurse specialist (CNS) telephone triage prior to appointments, and virtual multidisciplinary team (MDT) clinics and meetings. We switched to video consultations using the National Health Service (NHS) Attend Anywhere platform in June 2020. We describe our experience and the impact on service delivery and asthma control in a subset of patients who were monitored with home spirometry.

We aimed to answer the following questions: (1) Can children with DA who had previously performed spirometry reliably perform home spirometry and can they be monitored and managed remotely?; (2) Would the rate of failed appointment attendance reduce when virtual consultations replaced face-to-face consultations?

METHODS

Home spirometry

Patients aged 5 years or older who had previously reliably performed spirometry were issued home spirometers (NuvoAir, Stockholm, Sweden), based on clinical need. The number of unscheduled hospital admissions, steroid courses in the previous year, whether on a biological and family and patient willingness to perform home spirometry, influenced selection. Home spirometers were dispatched from 7 April 2020. The physiologists gave usage instructions, taught and checked technique with video calls for troubleshooting, and validated results (ATS/ERS criteria).

Forced expiratory volume in 1 s (FEV1) and forced vital capacity were collected on patients with home spimeters from 7 April to 31 October 2020. Patients were required to have at least one home measurement to be eligible for inclusion. The total number of FEV1 measurements, FEV1 reductions >20% and new actions taken (defined as: reviewing face-to-face, sending to general practitioner or emergency department for review, initiating steroid or antibiotic courses, dispatching electronic monitoring devices inhaleders and planning to initiate directly observed therapy once school resumed) were logged from patient records.

Adaptations to DA service

The DA CNS undertook preclinic telephone consultations to identify patients who would benefit from face-to-face reviews. Patients were asked to perform spirometry 24 hours prior to their clinic
appointment or if symptomatic. If spirometry was obstructive, the patient was asked to repeat spirometry after taking 400 µg salbutamol to assess bronchodilator responsiveness. Exhaled nitric oxide, blood tests or skin prick testing was only performed if patients were reviewed face-to-face. The CNS and physiology team were available on the telephone to help with patient queries during working hours. Patients were asked to inform us when they performed spirometry, as access to the NuvoAir portal was available in real time to make management decisions.

The pharmacy team initiated the homecare service for medications including biologics. Repeat prescriptions continued to be supplied by primary care but urgent changes to medication were dispatched by pharmacy.

Virtual home visits were undertaken by our CNS team instead of physical visits.

Our physiotherapists were redeployed to intensive care but continued to receive referrals and started video consultations from July 2020. Our clinical psychologist also undertook video consultations. The safeguarding team continued to work and liaise with the asthma team and social care.

Clinic attendance

We compared clinic attendance, either virtual or face-to-face, from March to August 2019 and 2020.

Statistical analysis

Data were analysed by Wilcoxon matched paired test, Spearman rank and Fisher’s exact test using GraphPad Prism software.

RESULTS

Home spirometry

Sixty-five patients were issued home spirometers. FEV₁ data were analysed in 50 (77%) patients. Fifteen patients were not included: 10 patients did not use the device, 3 lost devices, 1 returned device and 1 patient had significant comorbidities. The median age was 12.9 years (IQR 10.4–16.0) and 27 (54%) were male (table 1). In total, 253 FEV₁ measurements were performed. The median number of FEV₁ measurements per patient was 4 (IQR 3.0–7.0). Nineteen patients had 39 (15%) FEV₁ measurements that demonstrated >20% decrease in FEV₁. On 87% of occasions where FEV₁ decreased by >20% compared with best FEV₁, new action plans were initiated (34 actions in 39 patients).

Clinic attendance

Eighty-eight patients were seen in the monthly DA clinic from March to August 2019 (none virtually) compared with 110 patients seen from March to August 2020 (75 virtually). Thirty-five patients were seen face-to-face after CNS triage. Clinic non-attendance/cancellation rate in 2019 was 43% and 16% in 2020 (p<0.0003; figure 1).

Acute exacerbations

In the 50 patients who used home spirometers, 26 hospital admissions for acute asthma occurred between April and October 2019 and 6 in 2020 (p<0.01; table 1). Fifty-three (median 0.0, IQR 0.0–2.0) courses of steroids or antibiotics were prescribed from April to October 2019 and 47 (median 0, IQR 0.0–1.0) courses of steroids or antibiotics were prescribed in 2020 (p=0.81). Twenty-one (42%) patients were on biologics in 2020 and 15 (30%) patients in 2019.

DISCUSSION

During the COVID-19 pandemic, we rapidly transformed delivery of specialist asthma services demonstrating that virtual MDT clinics augmented by home spirometry is feasible, safe and acceptable to families. A sample of our clinic data suggests that moving to a hybrid interface and streamlining patients who would benefit most from face-to-face reviews may reduce cancellations and non-attendance. Engagement with home spirometry was varied (nearly 25% unused), but for those who regularly performed lung function, it was a useful adjunct in influencing clinical management decisions. Some patients used their home spirometers when symptomatic out-of-hours without informing the DA team, thus we were unable to initiate or give management advice until our physiologists became aware after checking the portal during normal working hours. We have since changed our policy and the family can inform the on-call respiratory registrar.

Prior to COVID-19 pandemic, few studies had investigated virtual clinics and monitoring in paediatric asthma. Moving to a virtual service was particularly important for families who were shielding. During COVID-19 pandemic, home spirometry has allowed clinicians to effectively monitor asthma remotely. Unfortunately, in our cohort, Asthma Control Test (ACT) scores

| Table 1: Patients with difficult asthma with home spirometers—demographics and outcomes |
|---|---|---|---|---|---|---|---|
| Age (years) | Total patients | Sex M:F | Biologics | Hospital admissions | Steroids/antibiotics | >20% decrease in FEV₁ | Action taken |
| 5–11 | 20 | 13:6 | 4 | 6 | 6 | 12 | 2 | 6 | 8 | 20 | 10 | 23 | 10 | 21 | 19 |
| 12–18 | 30 | 14:16 | 11 | 15 | 4 | 14 | 1 | 1 | 12 | 33 | 14 | 24 | 9 | 18 | 15 |
| Total | 50 | 27:23 | 15 | 21 | 10 | 26 | * | 3 | 6 | 20 | 53 | 24 | 47 | 19 | 39 | 34 |

Numbers without brackets=number of patients; numbers in brackets=number of episodes. Significant difference in hospital admissions between 2019 and 2020 (p<0.01). FEV₁, forced expiratory volume in 1 s.

were not recorded in a considerable number and this has now been added to our routine remote monitoring data collection.

Emergency visits for children with asthma across all severities decreased dramatically during the first wave of the COVID-19 pandemic. In nearly 90% of patients with >20% decrease in FEV1, new actions were taken that may have prevented unscheduled healthcare visits. Various reasons have been suggested including reductions in transmission of respiratory viruses, exposure to outdoor allergens and pollution. Adherence may have improved with increased parental supervision and priority given to asthma medication. These behavioural and environmental changes may have had a significant effect on our patients’ asthma control. We have shown a significant reduction in hospital admissions for acute asthma between April and October 2020 compared with 2019 with similar steroid and antibiotic use. We speculate that admissions but not treatments reduced because we were able to monitor patients more closely and use home spirometry as part of our assessment. This may have allowed us to initiate treatment earlier before further deterioration in asthma symptoms and the need for an unscheduled hospital admission. Data on the effect of COVID-19 on children with asthma are limited. However, adult data suggest that inhaled corticosteroids and biologics are safe and associated with a protective effect against severe COVID-19 infection.

In future, remote monitoring of anthropometric data, vital signs, actigraphy, point-of-care blood eosinophil counts, inhaler actuation and inhalation techniques, fractional exhaled nitric oxide (FeNO) and e-stethoscopes could be used in home evaluation of patients with asthma. More invasive investigations still require a hospital visit; the best mix of hospital and home care needs to be determined going forward. The COVID-19 pandemic gave us the unique opportunity to rapidly initiate and evaluate virtual clinics and home spirometry. These may be more accessible for patients and their families without compromising asthma control.

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REFERENCES