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| Paediatric guideline: Management of children and young people with asthma with proven or suspected adrenal insufficiency, including during intercurrent illness. |
| **Date effective from:** | 06/10/2021 | **Review date:** | 06/10/2021 |
| **Approved by:** | P&N D&T |
| **Approval Date:** | 06/10/2021 |
| **Author/s:** | Dr Louise Bath, Consultant Paediatric EndocrinologistDr Kathryn Macgill, Paediatric RegistrarAnn McMurray, Asthma Nurse SpecialistDr Kenneth Macleod, Consultant Respiratory PaediatricianEmilie Tennant, Senior Clinical Pharmacist |
| **Executive Lead:** | Dr Edward Doyle |
| **Target Audience:** | Paediatric medical and nursing staff working in the emergency department, general medical or asthma team. |
| **Supersedes:** | Management of children with asthma with proven or suspected adrenal insufficiency, including during intercurrent illness – June 2018. |
| **Keywords (min. 5):** | Asthma, steroids, adrenal insufficiency, short Synacthen® test. |

Version Control

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| --- | --- | --- | --- |
| **Date** | **Author** | **Version/Page** | **Reason for change** |
| May 2018 | Dr Louise Bath | Previous version  | Due for review  |
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1. Purpose

To provide guidance for paediatric staff involved in the care of children and young people with asthma who are at risk of, or are known to have adrenal insufficiency due to long-term steroid use. To ensure that all children and young people with asthma and proven or suspected adrenal insufficiency have a management plan for intercurrent illness or acute adrenal crisis.

1. Scope

All staff involved in the care of children and young people with asthma.

This will primarily be used by the asthma team to identify, investigate and manage children and young people at risk of adrenal insufficiency due to long-term steroid use.

It can also be used by medical/emergency department staff managing patients presenting acutely with known asthma and proven or suspected adrenal insufficiency.

1. Definitions

Glucocorticoids are steroid hormones produced by the adrenal cortex that have an essential role in supporting both resting and stress-related homeostasis. This is controlled through a negative feedback loop via the hypothalamic-pituitary-adrenal (HPA) axis. Long-term exogenous glucocorticoid use, such as high dose inhaled, oral or intramuscular steroids used in chronic asthma management, may influence this axis and suppress the body’s own endogenous glucocorticoid production. This is termed ‘adrenal insufficiency’ and can have life-threatening effects during acute illness or injury if additional exogenous glucocorticoid therapy is not given, as the body is unable to mount a stress response and produce the additional glucocorticoid required.

A short Synacthen® test is a dynamic function test used in the diagnosis of adrenal insufficiency. Please see separate guideline ‘Paediatric Guideline: Short Synacthen® Test for Children and Young People with Asthma on High Dose Corticosteroids’ for details of this investigation.

Intercurrent illness is defined as any acute illness or injury other than an asthma attack, such as upper or lower respiratory tract infection, gastroenteritis, trauma etc.

1. Roles and responsibilities

All health professionals involved in managing patients with asthma should consider risk of adrenal insufficiency. A short Synacthen® test should be arranged via the Asthma Nurse Specialists. Following the short Synacthen® test, the results will be reviewed by the Asthma Nurse Specialists and acted upon accordingly.

Discussion with or referral to the endocrinology team may be required.

1. Main content

5.1. Identification of children and young people with asthma at risk of adrenal insufficiency

The following children and young people with asthma are at risk of developing adrenal insufficiency and will require a short Synacthen® test carried out to assess their adrenal function.

* Those on high dose inhaled steroid doses: ≥ 800 micrograms beclometasone / budesonide or ≥ 500 micrograms fluticasone per day, for six months or longer.
* Those on maintenance oral prednisolone
* Those who have received three or more consecutive doses of intramuscular triamcinolone\*
* Those who have had repeated rescue courses of oral steroids (more than six courses in one year)
* Those who have a high burden of steroids via multiple different routes i.e. inhaled, nasal and topical.

\*Children and young people who have had treatment with intramuscular steroids for more than three months are presumed to have adrenal insufficiency.  Triamcinolone has very little cross reactivity against the cortisol assay, therefore those who have been on prolonged treatment should have a short Synacthen® test carried out within four weeks of last treatment.

5.2. Outcomes of short Synacthen® test

5.2.1. Normal result

If the results indicate an adequate response to Synacthen® (i.e. peak cortisol response > 430 nmol/L), no further action is required. The test should be repeated in a year if the patient continues to fulfil the criteria listed above. A letter should be sent to the GP advising that this test has been carried out, with a copy of the results included.

5.2.2. Proven Adrenal Insufficiency

**1. Baseline and peak cortisol undetectable (<40 nmol/L):**

If the short Synacthen® test results show a complete lack of response, the child/young person should be provided with hydrocortisone replacement therapy for maintenance (see Table 1) if they are not taking regular prednisolone.

Patients will require additional stress doses of hydrocortisone for use during intercurrent illness (other than asthma attack requiring rescue prednisolone), as per Table 2, if they are not on regular prednisolone or their usual dose of prednisolone is below the minimum for weight (see Table 3). They should continue their usual dose of prednisolone in addition to hydrocortisone during intercurrent illness.

These patients should all be discussed with the endocrine team.

**2. Baseline cortisol <100 nmol/L; peak cortisol <430 nmol/L:**

If the baseline cortisol is less than 100 nmol/L and the patient is not on regular prednisolone, they should be provided with hydrocortisone replacement therapy for maintenance (see Table 1).

Patients will require additional stress doses of hydrocortisone for use during intercurrent illness (other than asthma attack requiring rescue prednisolone), as per Table 2, if they are not on regular prednisolone or their usual dose of prednisolone is below the minimum for weight (see Table 3). They should be advised to continue taking their usual prednisolone dose in addition to hydrocortisone during intercurrent illness.

**3. Baseline cortisol >100 nmol/L; peak cortisol <430 nmol/L:**

Patients do not require maintenance hydrocortisone therapy, even if they are not on regular prednisolone.

Patients will require additional stress doses of hydrocortisone for use during intercurrent illness (other than asthma attack requiring rescue prednisolone), as per Table 2, if they are not on regular prednisolone or their usual dose of prednisolone is below the minimum for weight (see Table 3). They should be advised to continue taking their usual prednisolone in addition to hydrocortisone during intercurrent illness.

5.3. Presumed Adrenal Insufficiency

In exceptional circumstances when it has not been possible to perform a short Synacthen® test (e.g. ongoing requirement for high dose oral steroids or intramuscular triamcinolone or if the child doesn’t tolerate short Synacthen® test), a child or young person should be presumed to have adrenal insufficiency. The following advice should be implemented:

* If the daily dose of prednisolone is greater than the limit for weight on Table 3, or if they are on intramuscular triamcinolone, no sick day cover is required during intercurrent illness.
* If the daily dose of prednisolone is below the limits for weight in Table 3, then a short Synacthen® test should be arranged as soon as possible to determine the correct path to follow in the event of an intercurrent illness. If the test is not possible, hydrocortisone sick day cover should be provided.

5.4. Asthma attack in child/young person with adrenal insufficiency

In the event of a child/young person with proven or suspected adrenal insufficiency becoming unwell with asthma symptoms and requiring oral prednisolone as a rescue course, they do not require additional hydrocortisone stress dosing.

They should always have oral prednisolone as a reducing course, which should be discussed with the respiratory team.

**Table 1: Maintenance doses of hydrocortisone if the child or young person has adrenal insufficiency and is not taking regular prednisolone:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Weight (kilograms)** | **Body surface area (m2)** | **Morning dose hydrocortisone**  | **Afternoon dose hydrocortisone**  |
| 15 – 24.9 | 0.65 – 0.9 | 5 mg | 2.5 mg |
| 25 – 39.9 | 0.92 – 1.3 | 5 mg | 5 mg |
| 40 – 69.9 | 1.3 – 1.8 | 7.5 mg | 5 mg |
| >70 | >1.9 | 10 mg | 5 mg |

**Table 2: Stress dose of hydrocortisone for patients with known or suspected adrenal insufficiency during intercurrent illness (other than asthma attack requiring rescue prednisolone):**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Weight (kilograms)** | **Body surface area (m2)** | **Hydrocortisone dose for mild illness e.g. upper respiratory tract infection.** | **Hydrocortisone dose for moderate illness e.g. fever, gastroenteritis, pneumonia.** | **Emergency intramuscular (IM)/ intravenous (IV) hydrocortisone dose for severe illness/ vomiting or significant trauma\*** |
| 15- 24.9 | 0.65 – 0.9 | 5mg, 8 hourly | 5mg, 6 hourly | 50mg IM/IV |
| 25-39.9 | 0.92 – 1.3 | 7.5mg, 8 hourly  | 7.5mg, 6 hourly | 100mg IM/IV |
| 40 – 69.9 | 1.3 – 1.8 | 10mg, 8 hourly | 10mg, 6 hourly | 100mg IM/IV |
| >70 | >1.9 | 15mg, 8 hourly | 15mg, 6 hourly | 100mg IM/IV |

\*Patients should be advised to attend the nearest Emergency Department as soon as possible.

**Table 3: Minimum regular dose of prednisolone by weight, below which a patient should commence oral hydrocortisone ‘stress dosing’ during intercurrent illness:**

|  |  |
| --- | --- |
| **Weight (kilograms)** | **Daily oral prednisolone dose**  |
| 15 - 24.9 | 5mg  |
| 25 - 39.9  | 7.5mg  |
| 40 - 69.9 | 10mg  |
| >70  | 15mg  |

5.5. Referral to endocrinology

A referral or discussion with the endocrine team is required if a child or young person has:

* A suboptimal short Synacthen® test result and is aged less than 5 years.
* A peak cortisol <200 nmol/L or a baseline <50 nmol/L

5.6. Documentation of adrenal insufficiency

A steroid replacement action plan for children with asthma is provided with written information to support it.

All patients at risk of adrenal insufficiency should be given a steroid card by pharmacy.

An alert should be placed on the hospital IT system (TRAK) advising of adrenal insufficiency in case of unplanned hospital attendance. The ‘significant information’ section of TRAK should also be updated with the child/young person’s hydrocortisone sick day doses.

An alert should be placed on the Scottish Ambulance Service system.

A letter should be sent to the GP with a copy of the test results and information on how to manage illness in the future. The Asthma Nurse Specialists will provide a health care plan for school. The School Nurse or Asthma Nurse Specialists will provide the school with teaching on this condition and the management of illness or injury in school.

Children, families and school should be provided with the Scottish Paediatric Endocrine Group (SPEG) resource on adrenal insufficiency.

5.7. Further investigation

The child or young person with proven adrenal insufficiency should have a repeat short Synacthen® test in the future if they have a significant reduction in their overall steroid intake or if requested by the respiratory or endocrine consultant.

5.8. Management of children and young people with proven or suspected adrenal insufficiency presenting with suspected acute adrenal crisis

If a child or young person with asthma presents in a state of collapse with suspected adrenal crisis, they should be given emergency intramuscular/intravenous hydrocortisone (doses as per Table 2) and the separate guideline ‘Endocrinology: Management of known or suspected acute adrenal insufficiency’ should be followed – available in the emergency department and on the intranet.

5.9. Worked examples

**A 40 kilogram child is on regular 10 milligrams prednisolone daily and has known adrenal insufficiency (suboptimal short Synacthen**® **test result). Prednisolone is decreased in clinic to 5 milligrams daily because the asthma improves. What is the response?**

According to Table 3, the patient is now on a lower dose of prednisolone than the minimal acceptable stress dose. They should therefore be supplied with stress doses of hydrocortisone as per Table 2. Information should be supplied to parents, school and GP.

**The next month, the same child improves further and prednisolone is stopped. What should happen now?**

Prednisolone dose should be weaned and patient should be supplied with maintenance hydrocortisone as per Table 1, with advice to use stress doses as per Table 2.

**A different child (weight 40 kilograms) who has had continuous oral prednisolone for four months at a dose varying between 10 milligrams and 40 milligrams is slowly improving. Prednisolone is decreased to 5 milligrams but needs to continue. A short Synacthen**® **test has not been completed. What should the response be?**

Presumed adrenal insufficiency. The patient will require stress doses of hydrocortisone in the event of an intercurrent illness as per Table 2.

If prednisolone is stopped, a short Synacthen® test should be completed as soon as possible, with maintenance hydrocortisone started in the interim.

1. Associated materials

N/A.

1. Evidence base

British Thoracic Society and Scottish Intercollegiate Guidelines Network, (2014). *British Guideline on the Management of Asthma*.

Drake AJ et al. Symptomatic adrenal insufficiency presenting with hypoglycaemia in asthmatic children with asthma receiving high dose inhaled fluticasone propionate. *BMJ*. 2002; 324(7345): 1083-1091.

Paton J et al. Adrenal responses to low dose synthetic ACTH (synacthen) in children receiving high dose inhaled Fluticasone. *Arch Dis Child.* 2006; 91: 808-13.

NHS Lothian Biochemistry Lab Handbook

http://intranet.lothian.scot.nhs.uk/NHSLothian/Healthcare/A-Z/Laboratories/LabHandbooks/Pages/LaboratoryHandbooks.aspx.

1. Stakeholder consultation

N/A.

1. Monitoring and review

This guideline will be updated if any significant new evidence or national guidance is published; otherwise will be due for review in March 2024.