University Hospitals of Derby and Burton NHS Foundation Trust

Management of children on replacement corticosteroids - Paediatric Full Clinical Guideline - Derby and Burton

Reference no.: CH CLIN G 63

1. Introduction

To manage children and young people at risk of adrenal crisis safely.

2. Aim and Purpose

The guideline should be used for prevention and treatment of an acute adrenal crisis in children with hormone deficiencies (such as pituitary dysfunction, congenital adrenal hyperplasia [see also CH CLIN G102], primary adrenal failure and less commonly growth hormone deficiency) during illness and stress, including surgery. In an adrenal crisis, there is a risk of cardiovascular instability (i.e. tachycardia and hypotension), electrolyte disturbance, hypoglycaemia and seizures.

The guidance can also be used in any child treated with regular hydrocortisone, prednisolone or dexamethasone replacement therapy for long-term conditions (e.g. inflammatory bowel disease, arthritis, nephrotic syndrome) if they present with symptoms/signs of adrenal deficiency.

3. Definitions

Hypoglycaemia (in this context) is defined as a blood glucose level <3mmol/l.

Stress factors include accident, surgery, fever, vomiting.

Hormone deficiency is the inability to produce hormones physiologically

4. Main body of guidelines

In healthy children, cortisol is produced by the adrenal gland in stress and illness. Children on corticosteroid replacement are unable to compensate in the same way and are at risk of hypoglycaemia, hyponatraemia and hypotension. Children may present with non-specific symptoms such as fatigue, pyrexia, abdominal pain, dizziness, nausea and vomiting. Most children locally use hydrocortisone as corticosteroid replacement.

For minor illness without fever in a well child and for minor injuries including head injury with immediate recovery, no steroid dose change is required. If a patient is unwell e.g. infection with fever >38^{o}C, they will need to increase their hydrocortisone dose for the duration of the illness. If the patient presents to hospital due to lack of improvement, **or** drowsiness **or** vomiting, they require hydrocortisone by intramuscular or intravenous injection.

1. Check blood glucose (bedside + laboratory) and electrolytes.

2. Cortisol level should be requested in children on steroids not known to have hormonal deficiencies but result not needed before treating.

3. Give hydrocortisone intravenously or intramuscularly if delay in obtaining venous access. Doses can be used from BNFc (2mg/kg every 6 hours for children > 1 month of age [maximum of 100mg] and 4mg/kg every 6 hours for neonates [<28 days]) or:

Age	***Hydrocortisone dose***
Under 1 year	25mg
1-5 years	50mg
6 years and over	100mg

Intravenous hydrocortisone should be continued at a dose of 2mg/kg every 6 hours for children > 1 month of age and 4mg/kg every 6 hours for neonates until able to re-introduce usual oral steroids. The dose can be reduced to 1mg/kg 6 hourly if the child is stable and improving but unable to tolerate oral corticosteroids. The neonatal dose can be considered in children with faltering growth.

Subsequent oral doses of hydrocortisone should be given 6 hourly, with doses based on 30mg/m^2/day, rounded down to nearest 2.5mg:
e.g. for a child weighing 18kg, whose Body Surface Area is 0.73m^2, total daily dose is 21.9mg divided by four = 5.5mg. Doses of 5mg every 6 hours should be prescribed.

If the child usually takes fludrocortisone, this can be continued orally if tolerated. If unable to tolerate e.g. due to vomiting, the 'stress' doses of hydrocortisone are sufficient to have a mineralocorticoid effect and fludrocortisone can be stopped until able to tolerate oral medication when it can be re-started at usual dose.

4. If blood glucose is <3.0mmol/l, offer:

Age	**Glucose**	**Glucose drink (Lift or Lucozade)**
Under 1 year	5g	20mls Lift
1-5 years	10g	40mls Lift/ 115mls Lucozade
6 years and over	20g	80mls Lift/ 220mls Lucozade

5. Check blood glucose after 15 minutes to ensure good response and repeat if blood glucose remains <3.0mmol/l. Once blood glucose is above 3.0mmol/l, offer something to eat with carbohydrate, for example biscuits or toast.

6. If blood glucose <3.0mmol/l and the child is vomiting or drowsy, give 2mls/kg 10% glucose as a rapid infusion via a large vein. Check blood glucose after 15 minutes to ensure good response and repeat if blood glucose remains <3.0mmol/l

7. If the child remains drowsy, tachycardic, hypotensive or has reduced capillary return, give 10mls/kg 0.9% saline as a bolus.

8. Start intravenous 5% glucose 0.9% saline + potassium chloride at maintenance rates until fluids can be modified according to electrolyte results (See CH CLIN G 44).

9. If the child is on growth hormone replacement, this should be continued. It may prevent further hypoglycaemia

10. If the child is usually on desmopressin, it should be stopped as there is a risk of water overload and hyponatraemia. Fluid balance and daily weight should be recorded and desmopressin can be restarted after 24 hours if the child maintains a negative fluid balance and normal plasma sodium.

11. If the child has significant hyponatraemia, this needs gradual correction to avoid the risk of cerebral oedema or demyelination. Be cautious with rehydration also in children with a reduced conscious level or diabetes insipidus. Aim for correction of <10mmol/l sodium per day (less than 3mmol/l every 6 hours) and monitor serum sodium at least 4-6 hourly. Use a strict fluid balance and daily weight. Refer to UHDB guidance on intravenous fluid prescription in children (CH CLIN G44), section on management of hyponatraemia.

12. The child should be observed for at least 12 hours, with hourly blood glucose levels until he/she is eating and drinking and normoglycaemic, with no diarrhoea/vomiting. At this stage, the child can return to oral corticosteroids at higher dose of 30mg/m^2/day divided into 4 doses, given 6 hourly. Reduce dose over next 2 – 3 days until recovered from illness.

5. Surgery

Major surgery is defined as lasting more than 90minutes. Refer to: BSPED |BSPED Adrenal Insufficiency Consensus Guidelines, table 3.

For minor surgery (<90 minutes and expected to eat and drink by the next meal) -

If general anaesthesia required:

	Hydrocortisone bolus at induction	**Post-operative care**
>1 month of age	2mg/kg (maximum 100mg)	Oral 'sick day' doses for 24 hours (i.e. 30mg/m^2/day)
< 1 month of age	4mg/kg	

If general anaesthesia not required:

Minor procedures e.g. skin biopsy under local anaesthetic, tooth filling or extraction or scans using sedation	Give single oral 'sick day dose' (i.e. 30mg/m^2/day divided by 4). Continue for up to 24 hours if in pain or unwell.

6. Adrenal insufficiency card: bsped-ai-card-nov-2022-v1-4.pdf

7. References (including any links to NICE Guidance etc.)

- British National Formulary for children, 2022/23 or Hydrocortisone | Drugs | BNFC | NICE
- Emergency and peri-operative management of adrenal insufficiency in children and young people: BSPED consensus guidance November 2022.

8. Documentation Controls

Reference Number CH CLIN G63	**Version:** V1		**Status** Final	
Version / Amendment History	Version	Date	Author	Reason
	V1	23/11/23	Dr Tracy Tinklin	Review and update
Intended Recipients: Paediatric Consultants & Nursing staff at UHDB				
Training and Dissemination: Cascade the information via BU newsletter and address training				
Development of Guideline: Dr T Tinklin, Consultant Paediatrician & Helen Seddon, Specialist Healthcare Science Practitioner				
In Consultation with: Paediatric Pharmacists Paediatric Registrars & Lisa Hill (PaediatricEndocrine Nurse Specialist) Dr R Lloyd-Nash (Consultant Paediatrician) Dr P Vasista (Consultant Paediatrician)				
Linked Documents: (Nice guidance/Current national guidelines)				
Keywords: Corticosteroids Replacement, Adrenal Crisis, Hypoglycaemia, Addisons.				
Business Unit Sign Off	**Group:** Paediatric Guidelines Group **Date: 28/11/2023**			
Divisional Sign Off	**Group:** Women's and Children's Clinical Governance Group **Date: 30th November 2023**			
Date of Upload	01/12/2023			
Review Date	Nov 2028			
Contact for Review	Dr Tracey Tinklin			

9. Appendix 1: Flow diagram of management plan