Appendix 1

Guidelines for the peri-operative management of children with cortisol deficiency or adrenal suppression admitted for elective surgery

PRE-OPERATIVE MANAGEMENT

1. Identify patients at risk-

- Those on regular steroid replacement therapy
- Currently receiving steroids for a medical condition
- Those that have received more than 40 mg prednisolone (or equivalent) daily for more than 1 week or 2 mg/kg daily for 1 week or 1 mg/kg daily for 1 month
- Been given repeat doses in the evening
- Received more than 3 weeks treatment
- Recently received repeated courses (particularly if taken for longer than 3 weeks)
- Taken a short course within 1 year of stopping long term therapy
- Other possible causes of adrenal suppression
- Those who have completed a course of systemic glucocorticoids of less than 3 weeks duration in the week prior to surgery
- Patients receiving high dose inhaled corticosteroid therapy (greater than 200 micrograms/day of fluticasone or 250-600 micrograms/m2/day beclometasone- see table below).

Beclometasone*- adrenal suppression at risk dose range (inhalers range 50-250 micrograms per puff).	
Body weight	At risk dose range/day
12kg	>140-336 micrograms
20kg	>197-474 micrograms
30kg	>275-660 micrograms
40kg	>325-780 micrograms

* 1 microgram Beclometasone is approximately equivalent to 2 micrograms of budesonide.

2. Contact endocrinology and anaesthetic team

- Contact a member of endocrinology if the patient is known to the service
- Otherwise contact endocrinology at anaesthetists discretion
- Prior liaison with anaesthetic team is essential in patients currently receiving glucocorticoids where elective surgery is planned.

3. Management of usual oral and/or inhaled steroids

If patient on morning list

- Ensure first on list
- Give the evening dose as usual the day before surgery
- Omit morning AM dose (IV dose will be given in theatre).Ensure this omission is recorded on the Kardex with code (7) and note the reason as “on steroid protocol” in the Kardex information box.
- IF SIGNIFICANT DELAY GIVE NORMAL ORAL DOSE
- Continue usual dose of inhaled corticosteroids.

If patient on afternoon list

- Ensure first on list
- Give normal oral dose in morning (if omitted ensure given at induction)
- Check blood glucose.
- Continue usual dose inhaled corticosteroids.

4. Management of fluids and blood sugars

MINOR SURGERY

- Check blood sugar and discuss with anaesthetist if fluids needed.

MAJOR SURGERY

If on AM list;

- Check blood sugar from 6am every hour.
- At 6am start 0.9% sodium chloride + 5% glucose at 2/3 maintenance (calculated using trust policy)
- If blood glucose < 4mmol/L increase rate to full maintenance. Repeat blood glucose in 15 mins, if still <4mmol/L give 2mls/kg 10% glucose bolus. If 3 consecutive blood glucose <4mmol/L change fluids to 0.9% sodium chloride + 10% glucose. Monitor blood glucose every 15 mins until >4mmol/L.
- If the blood glucose remains less < 4mmol/L despite the above management then contact the endocrine team for advice.

If on PM list;

- Check blood sugar from 11am every hour.
- At 11am start 0.9% sodium chloride + 5% glucose at 2/3 maintenance (calculated using trust policy)
- If blood glucose < 4mmol/L increase rate to full maintenance. Repeat blood glucose in 15 mins, if still <4mmol/L give 2mls/kg 10% glucose bolus. If 3 consecutive blood glucose <4mmol/L change fluids to 0.9% sodium chloride + 10% glucose. Monitor blood glucose every 15 mins until >4mmol/L.
- If the blood glucose remains less < 4mmol/L despite the above management then contact the endocrine team for advice.

INTRA-OPERATIVE MANAGEMENT

MINOR

- At induction give 2mg/kg (maximum 100mg) IV hydrocortisone
- Repeat if procedure exceeds 4 hours

MAJOR

- At induction give 2mg/kg (maximum 100mg) IV hydrocortisone
- Repeat IV hydrocortisone on 4-hourly basis

POST-OPERATIVE MANAGEMENT

MINOR and MAJOR

- Continue IV hydrocortisone at 30mg/m2/day in 4 divided doses.
- This can be changed to oral hydrocortisone at the same dose if tolerating oral intake.
- Whilst on this higher dose of hydrocortisone, fludrocortisone should be omitted due to the mineralocorticoid effect of high dose hydrocortisone.
- Continue this increased dose for 24 hours for minor surgery before resuming the normal dosing regimen for that child which should now include the usual pre-operative fludrocortisone dose.
- Continue this increased dose for 48hours for major surgery before resuming the normal dosing regimen for that child which should now include the usual pre-operative fludrocortisone dose.
- The body surface area of the child can be estimated from the chart in the chart at the back of the BNFc (reproduced in Appendix 2).
- For example a child of 40 kg is estimated to have a body surface 1.3 m2. 30mg/m2/day =30mg x 1.3 x day = 39 mg. This should be given as 10mg hydrocortisone 4 times per day (dose rounded to make administration easier).
- Discuss with a clinical pharmacist or if not available the endocrine team if you are unsure.

FLUDS AND BLOOD SUGARS

- Fluids should be continued until tolerating oral fluids
- 0.9% sodium chloride +5% glucose IV infusion at calculated 2/3 maintenance
- At least one U&E in 24hours, if the child remains on IV fluids, or more frequent if suspected or confirmed electrolyte abnormality
- Regular post-operative blood glucose measurements should be undertaken at 2 hourly intervals
- Remember that hydrocortisone has marked mineralocorticoid activity and care must be exercised where water retention would be a disadvantage e.g. cerebral oedema, when dexamethasone should be used. Liaise with endocrine team in these circumstances.
- Adhere to trust policies on fluid prescribing and hyponatraemia.

Appendix 2 (Reproduced from BNFc 2016/2017)

BODY SURFACE AREA IN CHILDREN

Body-weight under 40kg

Body-weight (kg)	Surface area (m^2)
1	0.10
1.5	0.13
2	0.16
2.5	0.19
3	0.21
3.5	0.24
4	0.26
4.5	0.28
5	0.30
5.5	0.32
6	0.34
6.5	0.36
7	0.38
7.5	0.40
8	0.42
8.5	0.44
9	0.46
9.5	0.47
10	0.49
11	0.53
12	0.56
13	0.59
14	0.62
15	0.65
16	0.68

Body-weight (kg)	Surface area (m^2)
17	0.71
18	0.74
19	0.77
20	0.79
21	0.82
22	0.85
23	0.87
24	0.90
25	0.92
26	0.95
27	0.97
28	1.0
29	1.0
30	1.1
31	1.1
32	1.1
33	1.1
34	1.1
35	1.2
36	1.2
37	1.2
38	1.2
39	1.3
40	1.3

BODY SURFACE AREA IN CHILDREN

Body-weight over 40kg

Body-weight (kg)	Surface area (m^2)
41	1.3
42	1.3
43	1.3
44	1.4
45	1.4
46	1.4
47	1.4
48	1.4
49	1.5
50	1.5
51	1.5
52	1.5
53	1.5
54	1.6
55	1.6
56	1.6
57	1.6
58	1.6
59	1.7
60	1.7
61	1.7
62	1.7
63	1.7
64	1.7
65	1.8

Body-weight (kg)	Surface area (m^2)
66	1.8
67	1.8
68	1.8
69	1.8
70	1.9
71	1.9
72	1.9
73	1.9
74	1.9
75	1.9
76	2.0
77	2.0
78	2.0
79	2.0
80	2.0
81	2.0
82	2.1
83	2.1
84	2.1
85	2.1
86	2.1
87	2.1
88	2.2
89	2.2
90	2.2