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Admission pack for a child with

newly diagnosed diabetes

This pack is for use with a child or young person presenting with classical symptoms, signs and investigations consistent with newly diagnosed Type 1 Diabetes. If there is diagnostic uncertainty, discuss individual cases with the local children’s diabetes team.

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| Patient sticker: | Consultant: |
| Admission Date:  Admission Time: | Height (cm) & centile:  Weight (kg) & centile: |

**If the child is in DKA (deep breathing, vomiting, with ‘point of care’ ketone levels >3mmol/l, BG >11mmol/l, pH <7.3) follow the DKA integrated care pathway initially and fill out this clerking sheet once treatment is underway.**

**Note: the insulin dosing boxes on pages 6 – 9 of this document can also be used when changing a new patient from IV insulin to SC insulin if presenting with DKA.**

**Date:** **Time:**

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| **Presenting symptoms** | **Duration and nature** |
| Polyuria, polydipsia? |  |
| Bedwetting? |  |
| Weight loss? |  |
| Tiredness, lethargy? |  |
| Skin infections, thrush? |  |
| Constipation? |  |
| Other |  |
| Other diabetes related history: (e.g. What did parents think was the problem? Was there previous contact with a health professional (GP, HV etc)? | |

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| Past medical history/ previous hospital admissions/ birth history/ immunisations |

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| Drug history/ allergies |

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| Family history | Ask particularly about diabetes, other autoimmune conditions e.g. thyroid disease, coeliac disease. Also about CVD and hypertension |

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| Mother’s name:  Occupation: | Father’s name:  Occupation: |

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| School: |

**Examination and Investigations**

Height and Weight are recorded on the front of this pack.

**Observations**

|  |  |  |
| --- | --- | --- |
| Temp: °C | HR: | BP: |
| RR: | Sats: % | CRT: secs |

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| General appearance (evidence of weight loss, hydration state, drowsiness):  AVPU & GCS: |

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| **CVS**  Heart sounds  Peripheral pulses  Perfusion |  |
| **Respiratory**  Kussmaul breathing (if yes check gases urgently)  Expansion  Breath sounds |  |
| **Abdomen**  Hepatomegaly |  |
| **Neurological**  (if needed) |  |
| **Pubertal status**  Is the child in puberty, defined as breast development in a girl and testicular enlargement ≥4mls for a boy | **Yes / No**  Findings:  (this is essential as insulin dose is calculated accordingly,  however **If unsure select NO**) |
| **Other:**  E.g. skin – evidence of acanthosis nigricans |  |

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| **Point of Care Testing Result**  Blood glucose (mmol/l):  Blood Ketones (mmol/l):  Urine dipstix:  Blood gas: Arterial / Venous / Capillary (please circle)  pH  pCO2  pO2  Standard Bicarbonate  Base excess |

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| **Other blood tests** |  | Done () |
| Plasma glucose | grey |  |
| U+E | yellow |  |
| HbA1c | EDTA |  |
| TFT (TSH, Free T4) | yellow (full) |  |
| Anti TTG/IgA | yellow |  |
| Anti GAD antibodies | yellow |  |
| IA2 antibodies | yellow |  |
| ZnT8 antibodies | yellow |  |

Please inform the members of the Paediatric Diabetes MDT about the admission as soon as is practical.

Please telephone the paediatric diabetes specialist nurse 44525 (Richmond house); and leave voicemail

Diabetes consultant Dr Hawkes & Dr Goel via RGH switchboard

Dr Venkat, Dr Goyal, Dr Manikonda via NHH switchboard

Paediatric diabetes dietitian RGH 44288

If out of hours or a weekend leave a message.

Name of Doctor or Nurse completing the clerking:

Signature:

Date:

Time:

**Insulin Dose Calculation Sheet**

**ALL DOSES MUST BE CALCULATED BY 2 PEOPLE INDEPENDENTLY**

**(the prescriber plus one other healthcare professional)**

|  |  |
| --- | --- |
| Age: years, months | Weight (kg): |

**Fill in one of the age appropriate boxes below and on the following pages, sign it, have the calculation checked and write up the insulin prescription on the appropriate drug chart.**

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| **Under 1 year of age**  Neonatal diabetes needs to be discussed with the team.  If the child is **less than 1 year** discuss with the most senior member of the team available or if out of hours, the on-call Paediatric Consultant.  After discussion fill in the starting dose:  Total insulin dose per day = …………….Units/day of ……………..(insulin type)  Basal insulin name................ dose U/Kg ...............................  Bolus insulin name: ............., dose  OR  The diabetes MDT may choose to initiate insulin pump therapy from diagnosis | |
| Insulin prescribed:  Name:  Signature:  Date: | Insulin calculation checked by :  Name  Signature  Date |

|  |  |
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| **Age 1-4 years**  Total insulin dose per day = **0.7 units/kg/day =** …................. Units/day  **One third of this dose** is given as **BASAL** Insulin Degludeg (Tresiba) = …......... Units/day  (give 1st dose soon after admission and then subsequent doses the following evening)  **Remaining insulin** given as **BOLUS** Insulin. Insulin Lispro (Humalog)  This will be given as an insulin to carbohydrate ratio (ICR) of 1u:20g of carbohydrate with all meals and snacks. | |
| Insulin prescribed:  Name:  Signature:  Date: | Insulin calculation checked by :  Name:  Signature:  Date: |

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| Example: A 3 year old male child with a weight of 13.5kg diagnosed   * Total insulin dose per day (0.7 units/kg/day) = 9.5 units/day   + **One third given as Insulin Degludeg (Tresiba) = 3 units/day (round up or down to the nearest unit if necessary and give immediately)** * The remaining insulin is given as bolus insulin (e.g. Humalog) with all meals and snacks using the ICR of 1:20. Only administer if the child wants to eat or drink food containing carbohydrate   + - * Pre breakfast 1:20       * Pre lunch 1:20       * Pre tea 1:20       * Snacks 1:20   **Remember that half units can be given. For example a snack of 10g carbohydrate would require 0.5u and a meal containing 30g carbohydrate would require 1.5u.**  Insulin should always be given before food unless directed by the Diabetes Team. |

|  |  |
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| **Age 5 – 10 years**  Is the child in puberty? Yes / No **(If unsure select NO)**  If **in puberty**, total insulin dose per day = **1.0 unit/kg/day =** .................. Units/day  If **not in puberty,** total insulin dose per day = **0.7 units/kg/day =** ............... Units/day  **For both prepubertal and pubertal children give:**  **One third of this dose** as **BASAL** Insulin Degludeg (Tresiba) = ............... Units/day  (give 1st dose soon after admission, then subsequent doses the following evening)  **Remaining insulin given** as **BOLUS** Insulin, Insulin Lispro (Humalog). This will be given as an insulin to carbohydrate ratio (ICR) of 1u:15g of carbohydrate with all meals and snacks. | |
| Insulin prescribed:  Name:  Signature:  Date: | Insulin calculation checked by:  Name:  Signature:  Date: |

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| Example: An 8 year old male child with a weight of 28kg (not in puberty) diagnosed   * Total insulin dose per day (0.7 units/kg/day) = 19.5 units/day   + **One third given as Insulin Degledeg (Tresiba) = 6 units/day (round up or down to the nearest unit if necessary and give immediately)** * The remaining insulin is given as bolus insulin (e.g. Humalog) with all meals and snacks using the   ICR of 1:15. Only administer if the child wants to eat or drink food containing carbohydrate   * + - * Pre breakfast 1:15       * Pre lunch 1:15       * Pre tea 1:15       * Snacks 1:15   **Remember that half units can be given. For example a snack of 7g carbohydrate would require 0.5u**  **and a meal containing 52g carbohydrate would require 3.5u.**  Insulin should always be given before food unless directed by the Diabetes Team. |

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| **Age 11 (and over) years**  Is the child in puberty? Yes / No **(If unsure select NO)**  If **in puberty**, total insulin dose per day = **1.0 unit/kg/day =** .................. Units/day  If **not in puberty,** total insulin dose per day = **0.7 units/kg/day =** ............... Units/day  **For both prepubertal and pubertal children give:**  **One third of this dose** as **BASAL** Insulin Degludec (Treisba) = ............... Units/day  (give 1st dose soon after admission, then subsequent doses the following evening)  **Remaining insulin given** as **BOLUS** Insulin, Insulin Aspart (Fiasp). This will be given as an insulin to carbohydrate ratio (ICR) of 1u:10g of carbohydrate with all meals and snacks. | |
| Insulin prescribed:  Name:  Signature:  Date: | Insulin calculation checked by:  Name:  Signature:  Date: |

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| Example: A 14 year old pubertal female child with a weight of 50kg diagnosed:   * Total insulin dose per day (1.0 units/kg/day) = 50 units/day   + **One third given as Insulin Degludec (Tresiba) = 17 units/day (round up or down to nearest unit if necessary and give immediately)** * The remaining insulin is given as bolus insulin (Fiasp) with all meals and snacks using the   ICR of 1:10. Only administer if the child wants to eat or drink food containing carbohydrate   * + - * Pre breakfast 1:10       * Pre lunch 1:10       * Pre tea 1:10       * Snacks 1:10   **Remember that half units can be given. For example a snack of 5g carbohydrate would require 0.5u and a meal containing 75g carbohydrates would require 7.5u.**   * Insulin should always be given before food unless directed by the Diabetes Team. |

**Ongoing care from the Children’s Diabetes team**

**Blood glucose targets**

Patients should receive consistent advice to aim for blood glucose targets:

* 4-7 mmol/l pre meal,
* 5-9 mmol/l 2h post meal
* 6-10 mmol/l before bed.

**Dose Adjustment**

Both in hospital and following discharge, the starting doses of insulin will need to be frequently adjusted according to blood glucose levels. Some children will be sensitive to insulin and need dose reductions once normal glucose is achieved, particularly in rapid insulin doses. Others may need dose increases initially to achieve blood glucose targets.

**Correction Doses**

Additional rapid acting insulin (Fiasp or Humalog) should be given with the mealtime dose to correct hyperglycaemia. The CYP’s Insulin Sensitivity Factor (ISF) should be calculated to determine the falling in blood glucose to be expected for each extra unit of Fiasp or Humalog given. The ISF is calculated using the 100 rule 100

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Total Daily Dose of Insulin

E.g. Child on a total daily dose of 20u insulin. ISF = 100/20 = 5. Therefore 1 unit of rapid acting insulin will lower blood glucose by 5mmol/L. An additional correction dose should be calculated to achieve a target pre-meal blood glucose level of 5mmol/L.

E.g. In the child above (ISF=5) a pre-meal blood glucose of 15mmol/L would require an extra 2u of rapid acting insulin **in addition** to the usual mealtime dose.

**Hypoglycaemia before a meal**

If pre-meal blood glucose is < 4mmol/L the hypo should first be treated (see appendix 1) and the blood glucose retested after 10 – 15 minutes to ensure that it has increased to >4 mmol/l before the CYP eats their food. The meal time dose of insulin should then be reduced by the equivalent of 10g carbohydrate. E.g. If the total amount of carbohydrate in the meal is 50g, the insulin dose should be calculated for a 40g meal.

Basal insulin (Tresiba) should be adjusted to achieve a fasting (pre-breakfast) blood glucose level 5-7mmol/L. Adjustments to the basal insulin dose should not be made more frequently than once per week.

**NB: If the child or young person has had a hypo in the preceding few hours, DO NOT correct a high blood glucose level.**

**Insulin doses for carbohydrate containing snacks**

Bolus insulin (e.g. Insulin Lispro (Humalog) or Insulin Aspart (Fiasp)) should be injected for carbohydrate containing snacks from diagnosis as per the appropriate ICR.

**Prescribing / Completing Take home Medications**

Please note on the e discharge there is a section;

Paediatrics newly diagnosed type 1 diabetes 4 years and under

Paediatrics newly diagnosed type 1 diabetes 5 to 10 years

Paediatrics newly diagnosed type 1 diabetes 11 years and over

Please click on the appropriate link which will take you to a drop down menu to click the appropriate insulin and equipment necessary to take home

**Hypoglycaemia**

The hypoglycaemia guideline on management of low blood glucose (less than 4 mmol/l) is available in the Paediatric best practice guidelines on the ABUHB intranet under the diabetes and endocrinology section. (see appendix 1)

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| **Continuation Sheet- to be used by any team member** | | |
| **Date/Time** |  |  |
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**Discharge**

All boxes should be completed and signed prior to discharge.

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| --- | --- | --- | --- | --- |
|  | Yes | No | N/A | Signature |
| Seen by medical team |  |  |  |  |
| Seen by PDSN |  |  |  |  |
| Seen by paediatric dietitian |  |  |  |  |
| Seen by clinical psychologist |  |  |  |  |
| Structured education initiated using SEREN resources |  |  |  |  |
| Cannula removed (if inserted) |  |  |  |  |
| Follow up appointment to be arranged by team |  |  |  |  |
| Confirm new diagnosis bloods have been taken |  |  |  |  |
| TTH given and explained |  |  |  |  |
| HV/School nurse form completed |  |  |  |  |
| Parents understand how much insulin to give and what times to give it |  |  |  |  |
| Brecon register consent form completed and sent |  |  |  |  |
| GP letter sent / given to parents (including communication of prescriptions and devices according to local pathways) |  |  |  |  |

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| Time and date discharged home: |
| Any other comments:  Name  Signature Date |

Please code the admission episode at discharge (this allows correct ICD Patient Episode Data). Tick the correct box.

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| **CODE** |  |  |  |  | **USE FOR** |
| E10.9 |  |  |  | Diabetes without complications | Newly diagnosed patients with hyperglycaemia and no other complications |
|  |  |  |
|  |  |  |
| E10.1 |  |  |  | Diabetes with Ketoacidosis | If a new patient has presented with DKA |
|  |  |  |
|  |  |  |

2nd Edition

Date of Publication: May 2021

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**Management of Hypoglycaemia in**

**Children and Young People with Type 1 Diabetes**

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| --- | --- |
| **Document Title: Management and Support for Children and Young People with Type 1 Diabetes and HbA1c > 69 mmol/mol** | |
| Ratified by: | Children and Young People’s Wales Diabetes Network Guidelines Group |
| Date ratified: | January 2021 |
| Contributors version 1 | Dr Sunil Goyal, Consultant Paediatrician, Aneurin Bevan University Health Board  Claire Baker, SEREN Co-ordinator, Children and Young People’s Wales Diabetes Network  Children and Young People’s Wales Diabetes Network Guidelines Group |
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| Date for review in [insert name of health board]: |  |

***Document Control***

**Management of Hypoglycaemia in**

**Children and Young People with Type 1 Diabetes**

**Definition**

Hypoglycaemiain children and young people with diabetes is a blood glucose reading of ≤3.9mmols/L.

(This nationally accepted ‘4 is the floor’ in diabetes provides a safety margin. It should not be confused with the lower level of 2.5-2.8 mmol/L used for patients without diabetes.)

Hypoglycaemia is a common complication of managing diabetes

**Symptoms**

There are many signs and symptoms of hypoglycaemia and these willvary between individuals and may change with age. A child/adolescent may exhibit some of the symptoms below, while others may have no symptoms at all.

**This list is not comprehensive and if you think a child/adolescent is hypoglycaemic their capillary blood glucose MUST be checked.**

|  |  |  |
| --- | --- | --- |
| **Autonomic** | **Neuroglycopaenic** | **Behavioural** |
| * Pale * Sweating/clammy * Hungry * Shaking/ trembling * Restlessness | * Headache * Drowsiness * Confusion * Weakness, lethargy * Glazed expression * Visual/speech disturbances * Seizures * Unconsciousness | * Irritability * Agitation * Quietness * Mood change * Erratic behaviour/ tantrums * Nausea * Combative behaviour |

**It is important to explain to young people with Type 1 diabetes the effects of alcohol consumption on blood glucose levels, in particular the increased risk of hypoglycaemia including hypoglycaemia whilst sleeping.**

**Treatment**

The treatment of hypoglycaemia varies with the degree of severity. The severity of hypoglycaemia can be categorised as **mild**, **moderate** or **severe**.

For Children and Young people experiencing mild or moderate hypoglycaemia, they should receive the same treatment as there is little clinical research to suggest they are separate entities and require a different approach.

**Mild or Moderate** **Hypoglycaemia**: child able to tolerate oral fluids / Glucogel.

**Severe** **Hypoglycaemia** Unconscious or fitting child requires parenteral therapy (IM glucagon or IV glucose).

Also remember:

* Do not leave a child/Young person with hypoglycaemia alone.
* Do inform Paediatric Diabetes Nurse Specialists (PDSN) of any patients with diabetes presenting with hypoglycaemia to the ED / children’s assessment unit, even if not admitted.

**Hypoglycaemia awareness**

In individuals who do not have Type 1 diabetes, endogenous insulin is shut down and counter-regulatory hormones like glucagon, epinephrine and norepinephrine are released in response to hypoglycaemia.

In individuals with Type 1 diabetes glucagon responses to insulin-induced hypoglycaemia are lost in almost all patients by 5 years post diagnosis. This loss of response has been demonstrated as early as twelve months after the onset of disease and then they are primarily dependent on adrenaline response to negate the hypoglycaemic effect of insulin. Recurrent episodes of mild hypoglycaemia contribute to the development of defective counter regulatory hormone responses to subsequent reductions in blood glucose levels.

Impaired awareness of hypoglycaemia (IAH) is a syndrome which affects 20-25% of children and adults with type 1 diabetes in which the ability to detect the onset of hypoglycaemia is diminished or absent. The loss of autonomic symptoms precedes the neuroglycopenic symptoms and the patients are less likely to seek treatment for low blood glucose levels. As the awareness of low blood glucose level is impaired, hypoglycaemia is prolonged. These episodes, if unrecognised and prolonged over 2.15 to 4 hours can lead to seizures. Patients with IAH have a six-fold increase in severe hypoglycaemia episodes. Glycaemic threshold for cognitive dysfunction may be triggered before autonomic activation and hence the symptoms associated with IAH.

The blood glucose threshold for activation of autonomic signs and symptoms is related to glycaemic control, previous hypoglycaemia, exercise and sleep. Tight glycaemic control leads to adaptations that impair counter regulatory responses with a lower glucose level required to elicit an adrenaline response.

A previous episode of hypoglycaemia may reduce the symptomatic and autonomic response to subsequent hypoglycaemia, which in turn further increases the risk of subsequent severe hypoglycaemia.

Moderate exercise may also result in a decrease in symptoms of hypoglycaemia and decrease hormonal response the following day.

Most of the severe episodes of hypoglycaemia occur at night as sleep further impairs the counter regulatory hormone responses to hypoglycaemia in patients with diabetes. On the other hand, the blood glucose threshold for neuroglycopenia does not appear to vary as much with the level of glucose control nor with recurrent hypoglycaemia.

IAH is not an “all or none phenomenon”, but reflects a continuum in which differing degrees of impaired awareness can occur and can vary, over time, in any one individual. IAH is proposed to be a result of intra- and extracellular physiological adaptations to recurrent hypoglycaemia that are in essence survival responses designed to protect the cell from subsequent exposure to glucose deprivation .

There is evidence that IAH can be reversed by avoiding hypoglycaemia for two to three weeks, but this may be difficult to accomplish. Therapeutic options are limited although some individuals gain benefit from structured education or sensor-augmented pump therapy. NICE recommends CGM with alarms for managing impaired awareness of hypoglycaemia.

**Risk factors for hypoglycaemia**

The main risk factor for hypoglycaemia is a mismatch between administered insulin and consumed food. An excess of insulin could result from increased doses due to poor understanding of insulin action with over correcting or poor understanding of Carbohydrate counting or missed meals. Similarly, a relative insulin excess is seen in situations where glucose utilisation is increased during exercise or endogenous glucose production is decreased after alcohol intake.

# **Recurrent hypoglycaemia**

The majority of children with type 1 diabetes who experience severe hypoglycaemia have isolated events, however a small number experience recurrent episodes. When hypoglycaemia is recurrent, it is important to exclude Impaired Awareness of Hypoglycaemia and rule out co-existing autoimmune disorders like subclinical hypothyroidism, coeliac disease, and Addison’s disease.

Undisclosed self-administration of insulin causes repeated and unexplained severe hypoglycaemia and should be considered as a sign of psychological distress with underlying risk factors such as eating disorders (anorexia and bulimia) and depression.

**Clinical factors associated with increased risk of hypoglycaemia**

|  |
| --- |
| Precipitants |
| Excess insulin |
| Less food consumption |
| Exercise |
| Sleep |
| Alcohol ingestion |
| Risk factors |
| Impaired awareness of hypoglycaemia |
| Young age |
| Previous severe hypoglycaemia |
| Long duration of diabetes |
| Co-morbidities |
| Coeliac disease |
| Addison’s disease |
| Psychological distress |

**Evaluation and management of hypoglycaemic events**

|  |  |  |
| --- | --- | --- |
| Potential Cause | Factors | Management |
| Insulin action profile | What was the timing of insulin administration?  What is the peak insulin action? | • Consider rapid-acting and long-acting insulin analogues for multiple daily injections for more physiological insulin delivery  • Consider insulin pump therapy dual-wave insulin  bolus with low glycaemic meals |
| Recent food intake | What was the timing and amount of carbohydrate?    What was the peak glucose effect of recent food Intake? | • Review determination of carbohydrate value  • Review fat and protein content of meals  • Adjust food intake so that glycaemic peaks are more closely matched to insulin action peaks  • Daytime and bedtime snacks may need to be added, especially in younger children, if intermediate-acting insulin is used |
| Recent physical activity | What was the timing, duration and intensity of recent activity? | • Pre-exercise and post-exercise snacks (15-30 g) may be required  • Suspension of pump basal rate during exercise  • If exercise occurs at peak insulin action, additional carbohydrate may be required |
| Recent hypoglycaemia /lack of hypoglycaemic symptoms or hypoglycaemia unawareness | Has there been recent recurrent, severe hypoglycaemia?  (this may be associated with reduced  counter regulatory response)  At what glucose level do you start to recognise hypoglycemia?  What types of symptoms do you have? | • Glucose targets may need to be adjusted upwards in patients with recurrent hypoglycaemia and/or hypoglycaemia unawareness  • Consider increased monitoring of blood glucose levels  • Consider sensor-augmented pump therapy with  automated insulin suspension with sensor detected hypoglycaemia or sensor predicted hypoglycaemia    • Screen for underlying co-morbidities that can  predispose to recurrent hypoglycaemia |
| Prolonged, nocturnal hypoglycaemia | What are the glucose values overnight?  Blood glucose monitoring, in particular overnight, is  important in detecting hypoglycaemia and preventing serious and severe episodes. | • Consider increased overnight monitoring of blood  glucose levels  • Review insulin profiles  • Consider real-time CGM with or without  sensor-augmented pump therapy |

**Hypoglycaemia treatment**

Diabetes education should be focused toward recognition of risk of hypoglycaemia; ability to detect subtle symptoms; and confirm low glucose levels through regular self-monitoring, followed by appropriate hypoglycaemia treatment. If the blood glucose is ≤3.9 mmol/L, remedial actions to prevent further drop in glucose are recommended.

In adults, 20 g of carbohydrate in the form of glucose tablets raised glucose levels by approximately 2.5 to 3.6 mmol/L. This has been extrapolated to 0.3 g/kg in children which would be approximately:

* 5g for child less than 15kg
* 10 g of glucose for a 30 kg child
* 15 g for a child up to 50 kg

A paediatric study has shown that 0.3 g/kg of rapidly acting carbohydrate containing preparations (excluding jellybeans), effectively resolve hypoglycemia in most children and raise median blood glucose by 1 to 1.3 mmol/L in 10 minutes and 2 to 2.1 mmol/L in 15 minutes without rebound hyperglycemia at the next meal. A similar weight-based approach was also found to be effective in children on insulin pumps.

After treatment, retest blood glucose after 10 to 15 minutes. If there is no response or an inadequate response, (BG still less than 4.0mmol/l) repeat oral intake as above. In general, the initial therapy with rapidly acting carbohydrate is followed with a small (eg10g) of slower-acting carbohydrate snack such as bread, milk, biscuits, or fruit. However, this is not always required, particularly for those on insulin pump therapy.

Essentially, it is important to remember that the amount of carbohydrate required will depend on the size of the child, type of insulin therapy, active insulin on board, the timing and intensity of delete exercise, and other factors.

If the hypo is just before a meal time (when insulin is usually given) the hypo should be treated first and once the blood glucose is >4.0 mmol/L insulin should be given at a slightly reduced dose (reduced by equivalent of 10g less carbohydrate in meal).

**DO NOT OMIT INSULIN** – this is especially important with an early morning hypo.

**All families should be given copies of the SEREN Hypo Sheets (see Appendix, p.10ff). There are two sheets available covering insulin pen and insulin pump use.**

**Severe hypoglycaemia**

Urgent treatment is required in the event of severe hypoglycaemia and can be safely reversed by injection of glucagon, a potent and effective agent that can be administered intravenously, IM or SC. Recombinant crystalline glucagon is available as a lyophilized powder that is mixed with an aqueous diluent to a concentration of 1 mg/mL.

The recommended glucagon dosing is weight based: 1 mg for adults and children >25 kg (age >8 yrs) and 0.5 mg for children <25 kg (age < 8 yrs) (according to Novo Nordisk manufacturer guidelines) while Eli Lilly uses a weight cut-off of 20 kg. The evidence for these recommendations is unclear. Glucagon often induces nausea and vomiting on regaining consciousness and hence it is important to continue close observation and glucose monitoring after treatment. Side effect profile increases with repeated doses. The efficacy of glucagon is also dependent on the glycogen stores in the liver and hence would be predicted to be less efficacious in cases of prolonged fasting and parenteral glucose would be the therapy of choice.

In a hospital setting, intravenous glucose or glucagon may be given. Intravenous glucose should be administered by trained personnel over several minutes to reverse hypoglycaemia. The recommended dose is glucose 10% to 20%, for a total of 200 to 500 mg/kg of glucose. Rapid administration or excessive concentration (ie, glucose 50%) may result in an excessive rate of osmotic change with risk of hyperosmolar cerebral injury.

In the event of recurrent hypoglycaemia, the child will require additional oral carbohydrate and/or intravenous infusion of 10% glucose, 2 to 5 mg/kg/min (1.2-3.0 mL/kg/h).

In the outpatient setting, the predisposing events that led to the severe event should be evaluated to allow for prevention of future events. Caregivers need to be aware that following a severe hypoglycaemic event, the child will be at significantly higher risk of a future event and alterations to therapy may be appropriate.

Note:

* If frequent hypoglycaemia and /or recurrent seizures especially if at young age, diabetes team should consider referral for assessment of cognitive function.
* If frequent unexplained hypoglycaemia consider evaluation for other causes such as unrecognised coeliac disease or Addison’s disease.
* Glucagon should be readily accessible to all parents and caregivers, especially when there is a high risk of severe hypoglycaemia. Education on administration of glucagon is essential
* Blood glucose monitoring should be performed prior to exercise, and extra carbohydrates may be consumed based on the blood glucose level and the expected intensity and duration of the exercise

**References**

Abraham et al (2018*). ISPAD Clinical Practice Consensus Guidelines 2018. Assessment and management of hypoglycemia in children and adolescents with diabetes.*  Pediatric Diabetes October 2018; 19 (Suppl. 27): 178–192. DOI: 10.1111/pedi.12698. Epub 2018 May 28. Available online from: <https://cdn.ymaws.com/www.ispad.org/resource/resmgr/consensus_guidelines_2018_/12.assessment_and_management.pdf>

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**Appendix – SEREN Hypo Sheet (2 versions)**

These sheets are available for distribution electronically and physically. Please contact the SEREN Co-ordinator on [SEREN.diabetes@Wales.nhs.uk](mailto:SEREN.diabetes@Wales.nhs.uk) for copies.



