

Emergency Room Management Guidelines for the Child with Type 1 Diabetes

Diabetic Ketoacidosis (DKA)

History (some or all of)

- Polyuria
- Polydipsia
- Weight loss
- Abdominal pain
- Tiredness
- Vomiting
- Confusion
- Difficulty breathing

Clinical Signs generally include

- Deep sighing respirations – (Kussmaul breathing) with no wheeze or rhonchi
- Smell of ketones on breath
- Lethargy/drowsiness
- Dehydration – mild to severe

- Urine ketones/glucose
- Capillary glucose STAT in ER
- Venous blood – glucose, gases, electrolytes, urea, creatinine
- Other as indicated

Confirm DKA

- Ketonuria
- Glucose >11 mmol/L
- pH <7.3
- Serum Bicarbonate <18 mmol/L
- Consult Pediatrician immediately

Hypotension (PALS Values)

Age	Systolic BP (mm/Hg)
<1 month	< or = 60
1 month to 1 year	< or = 70
1 to 10 years	< or = 70 + (2 x age in years)
>10 years	< or = 90

Vascular Decompen-sation

- (with or without coma)
- Hypotension (see box)
 - Decreased level of consciousness

No Vascular Decompen-sation

Resuscitation

- Assess airway and breathing
- Apply 100% oxygen by mask
- **Normal Saline** 10 ml/kg to expand vascular space
- THEN**
- Decrease to 5-7 ml/kg/hr with Potassium Chloride as noted below
- **Only** infuse Sodium Bicarbonate (1-2 mEq/kg over 1 hour) if:
 1. Life-threatening hyperkalemia
 2. Inotrope-resistant shock
 3. Cardiac Arrest

- Clinically Dehydrated
- Hyperventilating
- OR**
- Vomiting
- Normal BP (lying and sitting)

- Minimally dehydrated
- Tolerating fluids orally
- Normal bowel sounds
- Normal mental status

- **Normal Saline** 7 ml/kg over 1st hour with Potassium Chloride as noted below
- THEN** 3.5-5 ml/kg/hr

- Oral hydration
- S/C insulin (see illness rules)

After 1st Hour of IV Fluids

- If history of voiding within last hour and Potassium <5.5 mmol/L, add 40 mEq/L of Potassium Chloride to IV fluid
- Aim to keep Potassium between 4-5 mEq/L
- Continuous insulin infusion 0.1 units/kg/hr = 1ml/kg/hr (of solution of 25 units of Regular Insulin in 250 ml Normal Saline). Include this amount in total fluid intake.
- **DO NOT GIVE BOLUS OF INSULIN**
- Continuous cardio-respiratory monitoring (with EKG tracing)

Neurological deterioration

- Headache, irritability, decreased level of consciousness, decreased HR
- First rapidly exclude hypoglycemia by capillary blood glucose measurement
- THEN**
- Treat for cerebral edema

Acidosis not improving

- (in 3-4 hours)
- Check insulin delivery system
 - Consider sepsis
 - Contact Tertiary Pediatric Diabetes Centre

Acidosis improving

- Blood glucose <15 mmol/L
- OR**
- Blood glucose falls >5 mmol/L/h after 1st hour of fluids
- Change IV to D5/Normal Saline with Potassium as above
- Decrease insulin to 0.04-0.05 U/kg/hr = 0.4-0.5 ml/kg/hr of standard solution as above
- Blood glucose <10mmol/L change to D10/Normal Saline with Potassium as above

- 20% Mannitol 5 ml/kg over 20 minutes
- If Sodium has declined, administer 2-4 ml/kg of 3% saline over 10-20 min.
- THEN**
- Normal Saline @ maintenance IV rate
- Decrease insulin to 0.04-0.05 U/kg/hr = 0.4-0.5 ml/kg/hr of standard solution as above
- Contact Tertiary Pediatric Diabetes Centre
- Admit to ICU

- Improvement
- Clinically well
- Tolerating oral fluids
- Ph >7.3
- Bicarbonate >18mmol/L
- Start S/C insulin
- Stop IV insulin ½ hour after S/C dose of rapid-acting or 1 hour after S/C dose of regular insulin
- Determine cause of DKA
- Contact regional Pediatric Diabetes Education Centre

Observation and Monitoring

- Hourly blood glucose (capillary)
- Aim for a decrease in blood glucose of 5 mmol/L/h
- Strict hourly documentation of fluids input/output
- Calculate and review fluids balance at least every 4 hours
- Hourly, at least, assessment of neurological status for a minimum of 24 hours
- 2-4 hours after start of IV – electrolytes, venous gases – then Q2-4h
- Follow Effective Osmolality = (2x measured Sodium + measured blood glucose)
- Avoid a decrease of >2-3 mmol/L/hr in effective osmolality by increasing IV sodium concentration

Hypoglycemia (moderate or severe)

History

- Recent hypoglycemic event requiring treatment by another person with Glucagon or oral glucose especially if
- Increased confusion
 - Decreased consciousness

AND/OR

Clinical Signs

- Seizures
- Hemiparesis
- Any localizing neurological findings
- Altered state of consciousness

- Obtain a blood glucose (capillary)
- Electrolytes and Gases not usually necessary

- IF** child is active, alert, and tolerating oral fluids well, then encourage glucose-containing drinks at least at maintenance fluid rate
- OTHERWISE**
- Start IV – at least 5% glucose in saline at maintenance rate, regardless of blood glucose level

- If drowsy, and any neurological impairment, localized or generalized:
- IV Bolus of 0.25-0.5 grams/kg of 50% glucose (0.5-1.0 ml/kg) **OR** 25% glucose (1-2 ml/kg)

- Continue IV glucose until:
1. Child has no further neurological signs and
 2. Child is no longer drowsy, confused, irrational or restless. (May take up to 12 hours if hypoglycemic encephalopathy is present)
 3. Maintain blood glucose >8 mmol/L as above until IV fluids discontinued
 4. Then, change to oral sugar-containing fluids

Discharge

- Discharge **ONLY** when child is
- Fully alert
 - Tolerating oral fluids and
 - Free of neurological signs.

Observation and Monitoring

- Determine cause and arrange for follow-up
- Decrease all insulin doses by 20% for next 24 hrs
- Renew prescription for Glucagon if used

Intercurrent Illness

- If emesis 2x in past 4 hours, keep NPO for 4-6 hours

- No emesis **BUT** Not drinking

- No emesis Tolerating fluids

- Capillary glucose
- Venous blood – glucose, gases, electrolytes, urea
- Urine ketones

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- Venous blood – glucose, gases, urea, electrolytes
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IV fluids

- Severely dehydrated – Normal Saline (10 ml/kg) over 1 hour
- If glucose >20 mmol/L then Normal Saline at maintenance volumes
- If glucose <20 mmol/L then D5W./ Normal Saline at maintenance volumes
- Once voiding, add Potassium Chloride

Maintenance IV fluids

- 4 ml/kg/hr for 1st 10 kg
- 2 ml/kg/hr for next 10 kg
- 1 ml/kg/hr for next 10 kg

Hyperglycemic

- **Do not omit insulin**
- Use S/C insulin unless acidotic (see DKA guidelines)
- If Blood Glucose >11 mmol/L and mod-large ketones, then give usual insulin **PLUS** extra short or rapid-acting Q4h [10-20% of TOTAL (N&R or H) daily dose]

Hypoglycemic

- **Do not omit insulin**
- Decrease next scheduled insulin dose by 10-20%
- If **not** tolerating oral fluids then follow IV as per hypoglycemia guidelines
- **Otherwise** encourage carbohydrate-containing fluids

Discharge

- Tolerating oral fluids
- No other reason for hospitalization
- Replace usual meal plan with carbohydrate-containing fluids

Observation and Monitoring

- Input & Output Q4h
- Blood glucose Q2-4h (keep within 4-10 mmol/L)
- Test urine for ketones