Republic of Zambia

Ministry of Health

NON-COMMUNICABLE DISEASES GUIDELINES

DIABETES

03

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DIABETES

Volume 3

CHAPTER THREE

DIABETES MELLITUS (DM)

DEFINITION & CLASSIFICATION OF DIABETES MELLITUS (DM)

Type 1 diabetes mellitus (T1DM)
This is due to an absolute lack of insulin as a result of pancreatic beta cell destruction and comprises 5% to 10% of all diabetes.

Type 2 diabetes (T2DM)
This is due to a relative lack of insulin and comprises 85%-90% of all diabetes cases. In the majority of patients it is as a result of life style. The disease takes a very silent course and is often detected on routine screening of urine or blood test, with the diagnosis being made after 40 years of age.

Other types of diabetes are associated with certain conditions and syndromes such as malnutrition in infancy and early childhood, gestational diabetes, endocrine tumours, and drugs which impair insulin production e.g diuretics, phenytoin)

EPIDEMIOLOGY
The World Health Organization (WHO) estimates that more than 180 million people worldwide have diabetes .This number will be more than double by 2030.

The few epidemiological studies conducted in Africa have demonstrated that diabetes is frequently undiagnosed (2-3undiagnosed cases for every known case). In most cases, it is one of the complications of diabetes that prompts the patient's first presentation.

The Zambia Steps Study done from 2009-2011 in Lusaka, Kaoma , Kasama demonstrated that 3.2% of the population has diabetes.

CAUSE/RISK FACTORS OF DIABETES
- Genetic
- Overweight and Obesity
- Physical inactivity
- Previous Gestational Diabetes
- Excessive energy diet and life style
- Infants fed on bovine milk

Presentation
- Polyuria
- Polydipsia
- Weight loss
- Disorientation, semi-comatose or comatose

Diagnosis

The diagnostic criteria of diabetes mellitus are as shown in the table below;

	Fasting Blood Sugar	Random Blood Sugar	HBA_1C
Normal	<6.1 mmol/L	<7.8 mmol/L	-
Impaired Glucose Tolerance	6.1-6.9 mmol/L	7.8-11 mmol/L	-
Diabetes	More than or equal to 7 mmol/L	More than or equal to11.1 mmol/L	>5.5 mmol/L

Investigations

	Pre Hospital	1St Level	2nd Level	3rd Level
Urine glucosuria, ketonuria (+/-)	E	E	E	E
Blood sugar	E	E	E	E
FBC, urea, creatinine, electrolytes,	D	E	E	E
Plasma osmolality usually high-[2(Na^+ + K^+) + glucose + urea)]	D	D	E	E
Blood gases	D	D	E	E
Sepsis screen(CXR, urine MCS, blood culture)	D	D	E	E
ECG	D	D	E	E
Cardiac enzymes	D	D	D	E

E-Essential
D-Desirable

PREVENTION AND CONTROL OF DIABETES

CONSTITUTE A MULTIDISCPLINARY TEAM

Build capacity in

Community Volunteers

-As health and peer educators to:

- Conduct health talks on diabetes in communities
- Disseminate health promotion messages[exercise, healthy diet]
- Raise awareness on other health ailments

Health workers

- To conduct for diabetes[random blood sugar]
- To conduct screening for hypertension[blood pressure]
- Do anthropometry measurements[body mass index, waist circumference, Skin-fold thickness]
- Offer specialized advice to persons with diabetes to prevent complications

Advocacy

- Involve stakeholders in resource mobilization
- Involve media in promoting diabetes prevention messages
- Involve local political members in advocating for decision makers and civil society support

MANAGEMENT OF DM

FLOW CHART FOR DIAGNOSIS AND TREATMENT OF DIABETES PATIENTS AT PRE-HOSPITAL (POST/ HEALTH CENTRE)

Patient complaining of the following:

- Polydipsia [excessive hunger]
- Polyuria [passing a lot of urine
- Loss of weight
- Fatigue
- Nocturia [passing a lot of urine at night]
- Vaginal candiasis [vaginal thrush]
- Polyphagia [excessive eating]
- Recurrent infections

- Do urinalysis [multi-stix or laboratory]
- Do blood sugar [glucometer or laboratory]

Normal

- Blood sugar less than 6mmol/L [fasting] or less than7.8mmol/L [random]
- Urinalysis- no sugar no ketones

Diabetes

- More than 7mmol/L[fasting] or more than 11.1mmol/L [random]
- Presence of glucose in urine

MANAGEMENT OF DM TYPE 1

- Look for other causes or symptoms of causes

- If dehydrated, rehydrate the patient then transfer to next level of care

- Establish the diagnosis (i.e. high blood sugar > 11 mmol/L, glucosuria, ketonuria)
- Asses the patient hydration status and treat accordingly.

For detail of rehydration and insulin treatment refer to the DKA protocol.
Follow up should focus on the following:

- Diabetes education including behavior change
- Insulin treatment
- Monitoring (blood sugar control)
- Follow up should be done weekly after initial diagnosis for two weeks, then two weekly for one month, and 3-4 monthly thereafter.
- Monitoring for complications;
- Every diabetic patient should have ophthalmologic examination at least once a year
- Asses for urinary micro-albuminuria at least five years after diagnosis, annually (this requires a special assay)
- A neurological evaluation should be carried out at every visit to screen for diabetic neuropathy at least 5 years after diagnosis.

Complications

	Pre-hospital	Level 1	Level 2	Level 3
Blood sugar	D	E	E	E
Metabolic Complication	D	D	E	E
Stroke	D	D	E	E
Eye Complications	D	D	E	E
Kidney Complications	D	D	E	E
Pregnancy induced diabetes	D	D	E	E

E-Essential
D-Desired

TREATMENT

TYPE I

	Pre-hospital	Level 1	Level 2	Level 3
Diet & Exercise	E	E	E	E
Insulin	D	E	E	E

E-Essential
D-Desired

TYPE 2

	Pre-hospital	Level 1	Level 2	Level 3
Diet & Exercise	E	E	E	E
OHA	D	D	E	E
Insulin	D	E	E	E

E-Essential
D-Desired

Criteria for referral;

- Poorly controlled diabetes
- Stroke
- Eye complications
- Kidney complications
- Pregnancy especially in adolescents

Diabetes Ketoacidosis (DKA) Protocol

Definition

Diabetic ketoacidosis (DKA) is an acute, major,metabolic complication of diabetes. DKA mainly occurs in patients with type I diabetes.

Causes

- Previously undiagnosed diabetes
- Non-compliance to treatment
- Stress from intercurrent illness

Presentation

- Deterioration over time (days to weeks)
- Worsening Polyuria, Polydipsia
- Weakness, lethargy, nausea and anorexia
- Abdominal pain
- Tachycardia, orthostatic hypotension
- Halitosis (sweet, sickly smell)
- Continuous vomiting
- Severe dehydration
- Deep sighing breathing (Kussmaul breathing)
- Acidosis
- Confusion
- Disorientation, semi-comatose or comatose

Investigations

- Urine glucosuria, ketonuria
- Blood sugar
- FBC, urea, creatinine, electrolytes,
- Blood gases
- Anion gap $(Na^+ + K^+)-(Cl^- + HCO_3^-)$-normal anion gap < 17
- Sepsis screen(CXR, urine MCS, blood culture)
- ECG, cardiac enzymes

Management (in Level 2 and Level 3 hospitals)

- Admit to ICU
- Insulin by infusion (0.1IU/kg/hr) or 20IU IM stat then 6IU IM/hr
- Fluid replacement
- Potassium chloride
- Antibiotics
- Nasogastric tube
- Urinary catheter

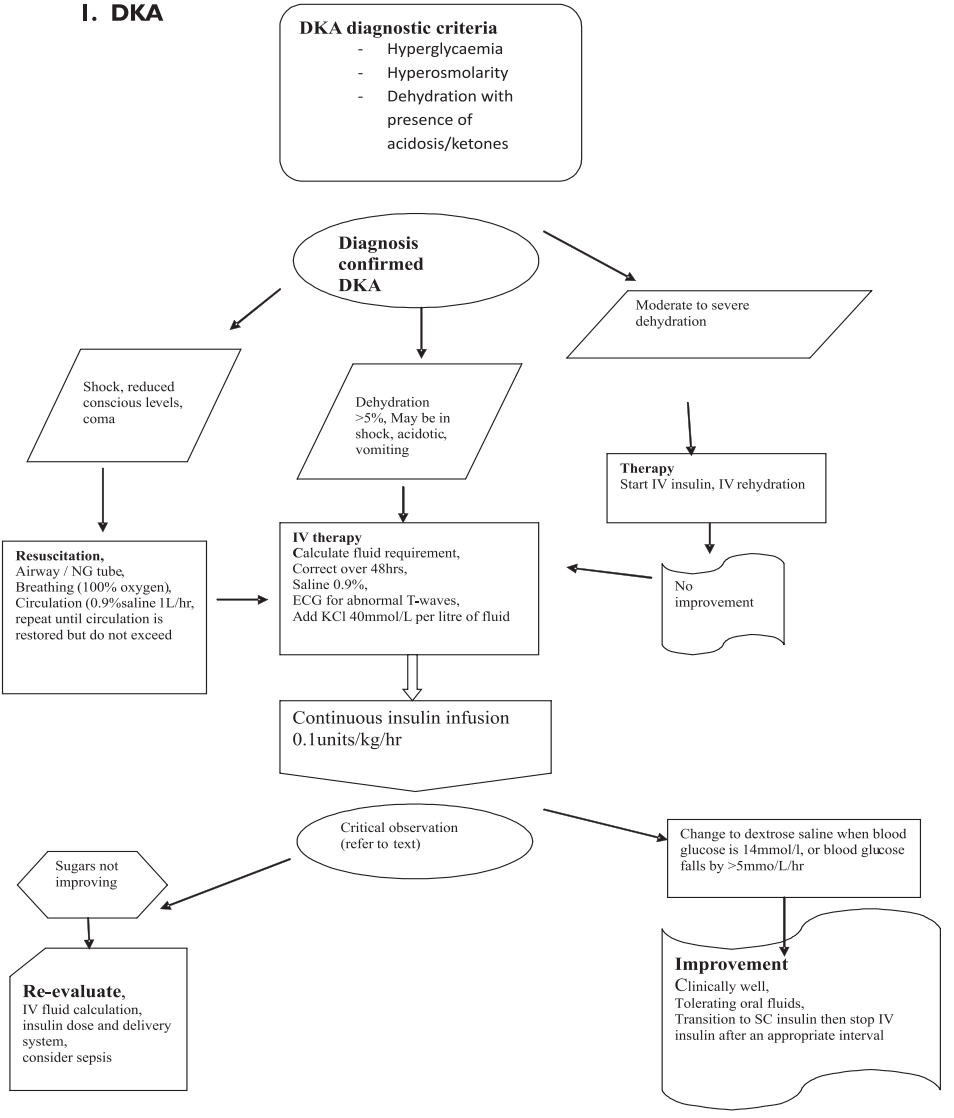
When blood sugar falls to 10-12 mmol/L

- change infusion to 5% dextrose with KCl given 8 hourly
- continue insulin therapy using sliding scale
- continue antibiotics

When stable and able to eat and drink fluids

- give insulin SC 8 hourly
- continue IV fluids 8 hourly

1. DKA



Hyperosmolar hyperglycaemic state (HHS) Protocol

Definition

HHS (previously known as Hyperosmolar Nonketotic Coma) is characterized by hyperglycemia, hyperosmolarity, and dehydration without significant ketoacidosis

Causes

- Intercurrent illness

Presentation

- Deterioration over time (days to weeks)
- Worsening Polyuria, Polydipsia
- Weakness, lethargy, nausea and anorexia
- Tachycardia, orthostatic hypotension
- Continuous vomiting
- Severe dehydration
- Visual disturbances
- Confusion
- Convulsions
- Disorientation, semi-comatose or comatose

Investigations

- Urine glucosuria, ketonuria (+/-)
- Blood sugar
- FBC, urea, creatinine, electrolytes,
- Plasma osmolality usually high-[2(Na^+ + K^+) + glucose + urea)]
- Blood gases
- Sepsis screen(CXR, urine MCS, blood culture)
- ECG, cardiac enzymes

Management (in Level 2 and Level 3 hospitals)

- Admit to ICU
- Insulin by infusion (0.1IU/kg/hr) or 20IU IM stat then 6IU IM/hr
- Fluid replacement 0.9% Normal Saline
- Give 50% Dextrose (D50W) IV bolus
- Antibiotics
- Nasogastric tube
- Urinary catheter

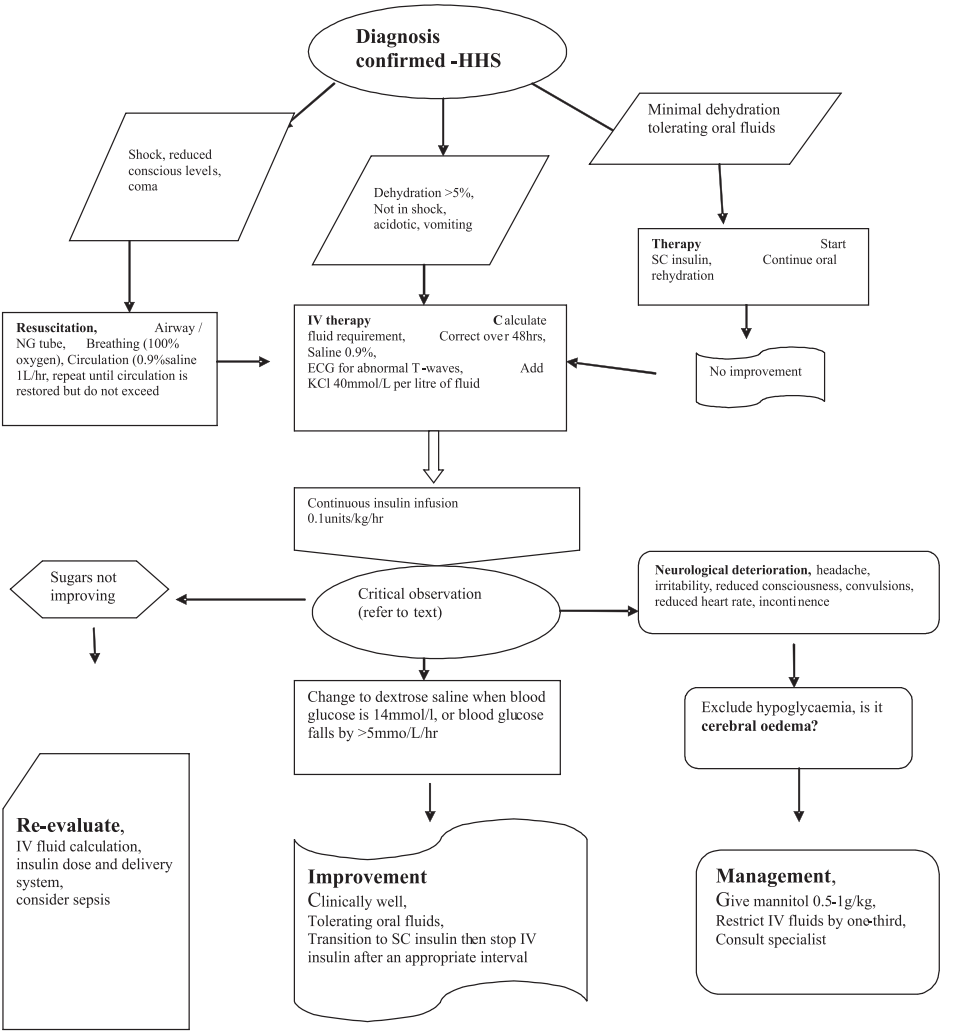
When blood sugar falls to 10-12 mmol/L

- change infusion to 5% dextrose with KCl given 8 hourly
- continue insulin therapy using sliding scale
- continue antibiotics

When stable and able to eat and drink fluids

- give insulin SC 8 hourly
- continue IV fluids 8 hourly

2. HONK



PEDIATRIC TYPE I DM

Diagnosis

The signs and symptoms suggestive of Type I Diabetes Mellitus

Non emergency presentation:

- Polyuria
- Polydipsia
- Loss of weight

- Nocturia
- Recent onset enuresis
- Fatigue
- Recurrent Infections

Emergency presentation

Most patients will present with Diabetic ketoacidosis (DKA), and may present as one of the following;

- Continuous vomiting
- Severe dehydration
- Deep sighing breathing (hyperventilation)
- Continuing polyuria despite the presence of dehydration
- Disorientation, semi-comatose or comatose

Investigations;

	Pre-hospital	1st Level	2nd Level	3rd Level
Urine glucosuria, ketonuria	E	E	E	E
Random /fasting blood sugar	E	E	E	E
FBC, electrolytes	D	E	E	E
Sepsis screen(CXR, urine MCS, blood culture)	D	E	E	E
Any other investigations as applicable	D	E	E	E

2nd and 3rd Level: The diagnostic criteria of diabetes mellitus are as shown in the table below;

	Fasting blood sugar	2 hour post prandial	HBA1C
Normal	< 6.1mmol/L	< 7.8mmol/L	-
Impaired glucose tolerance	6.1 to 6.9mmol/L	7.8 to 11mmol/L	-
Diabetes	More than or equal to 7mmol/L	More than or equal to 11.1mmol/L	>5.5mmol/L

Management

1st level

Urgent same day referral to the Hospital
Emergency care;
Establish the diagnosis (i.e. high blood sugar > 11mmol/L, glucosuria, ketonuria)
Asses the patient hydration status and treat accordingly.
For detail of rehydration and insulin treatment refer to the DKA protocol.
Refer the child/young person to a facility which has ICU or HDC unit

2nd level

Involve the child/young person and family in making decisions
The child should be admitted for in-patient treatment and monitoring
Offer education about insulin:

- Monitoring glycaemic control, effects of diet, exercise and recurrent illness on glucose control, and avoidance, detection and management of hypoglycaemia.

Emergency care;
- Establish the diagnosis(i.e. high blood sugar > 11mmol/L, glucosuria, ketonuria)
- Asses the patient hydration status and treat accordingly.

For detail of rehydration and insulin treatment refer to the DKA protocol.

Insulin management
- The aims of insulin therapy are to provide sufficient insulin to cover basal requirements throughout a 24-hour period, and to deliver higher boluses of insulin that are synchronised with the hyperglycaemic effects of meals.
- The choice of insulin regimen may depend on factors such as age, duration of diabetes, lifestyle, targets of metabolic control, and individual patient/family preferences.

All insulin therapy is delivered as part of a 'package of care' that includes:
- Initial and continuing education
- Specific paediatric dietary management
- Specific practical instruction on the use of insulin delivery systems and blood glucose monitoring
- Initial and continuing support for living with diabetes
- Initial and continuing emotional and behavioural support

Commencing insulin therapy;
- Starting insulin will depend on several factors which include age, weight, type and duration of diabetes and glycaemic targets, stage of puberty, exercise patterns, nutrition intake e.t.c.
- Insulin requirements vary with the age of the patient.
  Patients in partial remission may require <0.5 IU/kg
- Prepubertal children usually will require between 0.7 IU -1.0 IU/kg
- During pubertal the insulin requirements may rise considerably to 1.0-2.0 IU/kg

Note;
The correct dose of insulin is that which achieves the best attainable glycaemic control for an individual child without causing obvious hypoglycaemia problems and excessive growth according to weight and height children's charts

Insulin Regimens;

Option 1
- Twice a day insulin dose. The most common type of insulin dosing
- This regimen usually combines short acting with intermediate acting insulin
- Usually given in the morning and evening. Two thirds of the daily dose is given in the morning and one third in the evening. The intermediate insulin comprises two thirds of the total dose while soluble insulin comprises one third.

Other Regimen

Option 2

Once a day insulin dose
- Insulin is administered once a day, usually intermediate insulin with or without short acting insulin given either in the morning or in the evening
- Three times a day

Level 2nd and 3rd :Glycaemic targets;

Generally the recommended targets are as follows;

	HbA1c	Pre-meal/fasting blood glucose
Glycaemic target	Less than or equal to 7	4 – 7mmol/L

- However the glycaemic targets in children have to be individualised, and may be slightly higher than indicated above due to the risk of hypoglycaemia.
- In addition to glycaemic targets, absence of major hypoglycaemia, and minimal to moderate hypoglycaemic episodes should be used as treatment goals

Adjusting insulin dose;

- Watch the pattern for 2-3 days
- Address hypoglycaemia first
- Aim for target fasting levels next
- Adjust by 2-4units or 10%
- Wait for 2-3 days

Monitoring glycaemic control;

- Urinalysis an indirect measure of high blood glucose, usually glucose will appear in the urine when blood sugar is above 10mmol/L
- Blood glucose a direct measure of the sugar levels in the blood
- Glucosylated haemoglobin (HbA1c) a measure of glucose control over a period of up to 3 months, and is a good predictor of long term complications

Self monitoring should be encouraged.

Criteria for referral;

- Poorly controlled diabetes
- Impaired growth and development
- Eye complications
- Kidney complications
- Pregnancy especially in adolescents
- Other associated complications

Diabetic Ketoacidosis (DKA)

DKA results from absolute or relative deficiency of circulating insulin and the combined effect of increased counter regulatory hormones namely catecholamine, glucagon, cortisol and growth hormone.

The biochemical criteria of DKA is as follows

- Hyperglycaemia
- Venous pH < 7.3 or bicarbonate < 15mmol/L
- Ketonaemia/ketonuria

Goal of therapy

- Correct dehydration
- Correct acidosis and reverse ketosis
- Restore blood glucose to near normal
- Avoid complications of therapy
- Identify and treat any precipitating events

Management

Supportive measures

- A- Airway, B- Breathing and C- Circulation
- Give antibiotics to febrile patients
- Catheterize the bladder in unconscious patients

Fluid management

- Evaluate the degree of dehydration
- If in shock rapidly restore circulatory volume with isotonic saline or ringer's lactate in 20mL/kg bolus. The volume administered is 10mL/Kg/hr over 1-2hrs and may be repeated as necessary
- Subsequent fluid management should be with 0.9% saline or Ringer's lactate and should be calculated to rehydrate in 48hrs using infusion pump.
- The rate of infusion each day should not exceed 1.5 to 2 times the usual daily maintenance requirement based on age, weight or body surface area

Insulin therapy

- Start insulin therapy 1-2hrs after starting the initial fluid replacement
- The insulin dose should be 0.1unit/kg/hr in a known diabetic and 0.05 units/kg/hr in a newly diagnosed patient.
- The insulin dose should be maintained until the resolution of the DKA
- The plasma glucose concentration should typically decrease by 2-5mmol/L.
- To prevent hypoglycaemia add 5% dextrose to the fluids when the blood sugar falls to approximately 14-17mmol/L
- Keep the blood sugar at approximately 11mmol/L until resolution of DKA

Potassium replacement

- Even with normal or high levels of serum potassium at presentation, there is always a total body deficit of potassium

- Whenever possible potassium replacement should be guided by serum potassium levels
- The starting potassium concentration in the infusate should be 40mmol/L
- Potassium replacement should continue throughout the intravenous fluid therapy
- The maximum recommended rate of potassium replacement is usually 0.5mmol/Kg/hr

Note: In a case were results are not available, start potassium replacement when a child passes urine.

Biochemical assessment

Obtain blood samples for measurement of the following;

- serum/plasma glucose,
- electrolytes,
- blood urea nitrogen,
- creatinine, osmolality,
- venous/arterial pH, pCO2, calcium, phosphorus, magnesium,
- complete blood count, anion gap

In DKA the anion gap is typically 20-30mmol/L; an anion gap of more than 35mmol/L suggests concomitant lactic acidosis

Anion gap = Na (Cl + HCO_3): normal 12 plus or minus 2

Monitoring

Successful management of DKA requires meticulous monitoring of the patients clinical and biochemical parameters

- Hourly vital signs or more frequently as required (heart rate, respiratory rate, blood pressure
- Hourly neurological observation, i.e. GCS, change in neurological status,
- Hourly blood glucose
- 2 hourly fluid input and output
- 2 hourly serum electrolytes, urea and creatinine
- 2 hourly urine ketones
- Continuous cardiac monitoring
- Amount of insulin administered

Introduction of oral fluids and transition to subcutaneous (SC) insulin injections

- Oral fluids should be introduced only when substantial clinical improvement has occurred (mild acidosis/ketosis may still be present)
- When oral fluids are tolerated IV fluids should be reduced
- To prevent rebound hyperglycaemia the first SC injection should be given 1-2 hrs(with regular insulin) before stopping the insulin infusion. After transition to SC insulin frequent blood glucose monitoring is required to avoid marked hyperglycaemia and hypoglycaemia.

- The SC insulin can be given 6 hourly initially with frequent (hourly) blood sugar monitoring as above until the desired blood sugar levels have been reached.
- When the desired blood sugar control has been reached the frequency of SC insulin can then be reduced to twice daily or the desired dosing regimen. Note: Only change to the daily regimen when the ketones clear in the urine.

Complications of treatment

- Inadequate rehydration
- Hypoglycaemia
- Hypokalemia
- Hyperchloremic acidosis
- Cerebral oedema

Prevention of recurrent DKA and follow up

- Management of an episode of DKA is not complete until its cause has been identified and attempt made to treat.
- The patient should be followed up one week after discharge initially
- Diabetes education should be intensified during follow up to avoid recurrence of the DKA and to ensure good glycaemic control

Follow up; should focus on the following;

- Diabetes education
- Insulin treatment
- Monitoring(blood sugar control)
- Follow up should be done weekly after initial diagnosis for two weeks, then two weekly for one month, and 3-4 monthly thereafter.
- Check for signs of nutrient deficiencies.

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