



Research Article

Shadangodak in diabetic ketoacidosis - A case study

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ABSTRACT:

Background: Diabetic ketoacidosis (DKA) is a life-threatening problem that affects people with diabetes. It occurs when the body starts breaking down fat at a rate that is much too fast. The liver processes the fat into a fuel called ketones, which causes the blood to become acidic. ^A

In DKA treatment the primary aim of the management is to replace the loss of fluid so that the blood sugar levels restore to the normal range. Also potassium loss has to be replaced. According to Ayurveda the *-Muhurmuhu aushadhi sevan matra*. (Repeated doses) was used to hydrate the patient.

Clinical Details: A 19-year-old female patient with pain in abdomen, nausea, vomiting (non-projectile), shortness of breath on admission. The blood investigation reports denote that the Patient had anion gap of 21 with positive ketones, low bicarbonate & high blood glucose, urine glucose and high circulating blood ketones were strongly positive. Based on the laboratory findings patient had confirmed with DKA. Initially the insulin drip with electrolytes (potassium, sodium, phosphorus, magnesium, & chloride) was started and monitored. Along with this to overcome the complaint of excessive thirst and to rehydrate the patient Shadangodak a unique herbal combination of Ayurved was given frequently. The details of management of this case is presented in this case study!

KEY WORDS: Diabetes, Ketoacidosis, Hypokalemia, Insulin, Ketonebodies, glycosuria

INTRODUCTION:

DKA is a common but potentially lethal hyperglycemic condition in diabetic patients. DKA is more prevalent in type 1 diabetes patients. DKA may also be developed in type 2 diabetes patients. In management of DKA preventive measures are essential, including instruction for patients. Drugs including beta-blockers, diuretics, anti-psychotics, corticosteroids, or anticonvulsants can alter volume status as well as the metabolism of carbohydrates which may lead to DKA precipitation. Psychological disturbances, food disorders, malfunctioning of the insulin resistance to peripheral insulin resulting in DKA pathophysiology causing dehydration, hyperglycemia, electrolyte and ketosis

abnormalities. ^{[1-3].)} DKA is gradually developing condition but if vomiting occurs the symptoms may worsen quicker because of faster body fluid loss. Early symptoms, as well as indications of DKA, includes, Thirst, caused because of dehydration, Excessive urination, which arises when kidneys attempt to remove the excess glucose from the body, and water is evacuated as well with the glucose, elevated levels of blood glucose (sugar) ^[4, -5]. Ketones are present in the urine. Infection is the most prevalent factor in the development of DKA & HHS. Additional triggering variables include the termination or insufficient insulin treatment, myocardial infarction, pancreatitis, cerebrovascular, and drugs ^[6-7].

Pathophysiology: It's Pathophysiology involves-

1. Insulin deficiency: DKA typically arises when there is a significant shortage of insulin in the body, often due to missed insulin injections or inadequate insulin doses.
2. Elevated blood glucose levels: In the absence of sufficient insulin, glucose cannot enter cells for energy production, leading to high blood sugar levels (hyperglycemia).
3. Lipolysis: To compensate for the lack of glucose as an energy source, the body starts breaking down fats into fatty acids, leading to increased fat breakdown (lipolysis).
4. Ketogenesis: Fatty acids are converted into ketone bodies (acetoacetate and beta-hydroxybutyrate) in the liver as an alternative energy source.
5. Ketone accumulation: Ketone bodies accumulate in the bloodstream, resulting in ketonemia and subsequently leading to ketonuria (ketones in urine).
6. Acidosis: Accumulated ketones lower blood pH, causing metabolic acidosis, which can lead to a range of symptoms and complications, including electrolyte imbalances and organ dysfunction.

When the hyperglycemia worsens with a decrease in renal function. Use of potassium by skeletal muscles leads to significantly decrease in potassium level with hyper-osmolality resulting in depletion of intracellular potassium. which causes a severe total body potassium deficit. DKA patients may thus have a wide range of serum potassium levels. Insulin treatment and the hyperglycemia correction will result in potential hypokalemia [8-12].

Diagnosis:

The degree of DKA is categorized as mild, moderate, and severe depending on metabolic acidosis severe (blood pH, ketones & bicarbonate) and the presence of mental status affected (4). Severe dehydration and hyperglycemia with the changed mental state were characterized in the absence of severe acidosis. A major diagnostic characteristic of DKA is the high circulating blood ketone level, which results in a semi-quantitative estimate of levels of acetone and acetoacetate by the nitroprusside reaction. The anion gap is determined by extracting from the sodium concentration the amount of bicarbonate and chloride: $[Na - (Cl + HCO_3)]$. A typical anion gap between 7 & 9mEq/l indicates a metabolic acidosis with an anion gap of more than 10-

12mEq/l (4). However, hyperglycemia is a crucial criterion for DKA diagnosis, with admission a broad plasma glucose range may be found [13].

Shadangodak:

मुस्तपर्पटोशीर चन्दनोदीच्यनागरैः|

शृतशीतंजलं देयं पिपासा ज्वर शान्तये||

Musta, Parpatak, Usheera, Chandan, Shunthi, Hriber when taken in equal quantity it is called *Shadangodak*

It is described in charaka Samhita Jwara Chikitsa Adhyaya. It is used as *Pachana* drug in Ayurveda

षडंग पानीय

घन चन्दन शुण्ड्यम्बु पर्पटोशीर साधितं|

शीतं तेभ्यो हितं तोयं पाचनं तृट् ज्वरापहः||

Case Study:

A 19 year old female complaining of severe dyspnea at rest intense thirst, nausea, one episode of vomiting, severe abdominal pain, polyuria came to hospital at 2.30 am.

Known case of Juvenile Diabetes mellitus on injection Mixtard 20 u twice daily, h/o boils on buttock since 4-5 days. She was feverish due to the same early morning did not have food; due to anorexia; due to which her mother did not injection Mixtard to her. She visited general practitioner 2 days back for the boil.

Clinically: Severely dehydrated, tachypnic, typical shallow rapid respiration known as acidotic breathing

Pulse 140/minute, Blood Pressure 140/70 mm of hg, respiratory rate 50/minute, glucose on glucometer: 490mg/dl. She was agitated due to hyperventilating lungs. Urine ketones were +++ with electrolytes and arterial blood gases report was awaited.

- **Problems:** Type I diabetes mellitus, diabetic ketoacidosis hyperglycemia severe dehydration The bacterial infection in boils landed her into diabetic ketoacidosis.
- Admitted to intensive care unit fluid was started first bolus: 10ml/kg 0.9 % ns over half an hour second bolus 10ml/kg 0.9 % ns over half an hour. Short acting insulin used

(inj actrapid) as follows

- Inj. actrapid 0.2 units/kg (50 x 0.2=10 unit in this case) as bolus iv
- Followed by inj.actrapid 50 units infused in 50 cc 0.9 % ns by syringe pump at 4 units/hour, till BSL comes less than or equal to 250 mg/dl
- Then infusion was held and then glucose insulin drip started as DNS 500ml + 8 unit actrapid over 4 hours

Management Protocols:

- Correction of dehydration by fluids by Intravenous route. In this case Shadangodak was used is oral rehydration solution
- Correction of acidosis
- Use of short and rapid acting insulin
- Replacing potassium
- Treatment of precipitating factor

Fluid Replacement: Total deficit of 6 liters in an average adult in extracellular Fluid and intracellular fluid half the amount in extracellular Fluid should be corrected in first 3 and half hours taking precaution of fluid overload by measuring CVP if patient having underlying heart disease Sodium has to be monitored if levels high use 0.45 % NaCl half amount in intracellular fluid slowly replaced by glucose-insulin drip (which is called covered pint) when BSL comes to normal. Also potassium correction in early stage may be needed as insulin depletes potassium levels. Sodium bicarbonate in severe cases of acidosis need to be given. Over-correction as it may precipitate hypoxia. Correction of hypokalemia as insulin shifts the k⁺ intracellularly. If k⁺ level < 3.3 m eq/l infusion of insulin to be stopped. Also *Shadangodak* was given sip by sip (in *Muhurmuhu matra*) like ORS when patient was shifted in general ward.

Ayurvedic approach: Diabetic Ketoacidosis has very prominent symptom called *Trishna* which is intense thirst and *Shosha* (dryness of tongue). So according to the symptom the diagnosis is *Trishna*. *Trishna* and *Pipasa* are two commonly used words denoting desire for water, the difference between the two is, *Trishna* is pathological and *Pipasa* is physiological. Generally, desire for water is physiological process to maintain fluid balance but if dosha are vitiated then they can lead to excessive thirst and can produce *Trishna*, a disease in which person

constantly craves for the water. Beside independent disease, *Trishna* or thirst is also seen as prodromal symptom, clinical feature, complication, poor prognostic sign etc. in various clinical conditions.

Outcomes:

After the initiation of insulin treatment, potassium levels were shifted intracellularly and serum levels were declined. Insulin stimulated the transcellular potassium transmission and patient has developed with hypokalemia. Also *Shadangodak* helps in digestion of *Aama* and also acts as best rehydration solution as *Usheera* and *musta* are best in treating the *trishna* that is developed as a symptom. So it is one of best options if patient can take the oral fluids. It also minimizes risk of Pulmonary edema is intravenous hydration can be kept at its minimal levels and hence reduce the excess Burdon on Heart thereby reduce risk of fluid overload.

DISCUSSION:

In DKA treatment the primary aim of the management is to replace the lost fluid so that the blood sugar levels start to come to the normal limit. Also potassium loss has to be replaced. The optimum serum K⁺ has to be maintained. According to Ayurveda the "*Muhurmuhu aushadhi sevan matra*" was used to hydrate the patient. *Shadangodak* is an excellent option for oral rehydration Solution... as it has *Pachana* property so it not only hydrates the body tissues but also digest the *Aama*.

Mode of action of Shadangodak:- Diabetic Ketoacidosis has very prominent symptom called *Trishna* which is intense thirst and *Shosha* (dryness of tongue). So according to the symptom the diagnosis is *Trishna*. *Trishna* and *Pipasa* are two commonly used words denoting desire for water, the difference between the two is, *Trishna* is pathological and *Pipasa* is physiological. Generally, desire for water is physiological process to maintain fluid balance but if dosha are vitiated then they can lead to excessive thirst and can produce *Trishna*, a disease in which person constantly craves for the water. Beside independent disease, *Trishna* or thirst is also seen as prodromal symptom, clinical feature, complication, poor prognostic sign etc. in various clinical conditions.

Management/Avoid The DKA Complications:

Hypokalemia: Insulin stimulates transcellular potassium transmission and may result in hypokalemia, so IV potassium is overtaken by insulin infusions. Initially, due to dehydration as well as hyperosmolarity, potassium concentration may be normal or even high. The loss of potassium with glycosuria occurs.

Hypoglycemia: The continuous infusions of insulin can occasionally carry the glucose concentration below normal, but can be managed easily by initiating an infusion of D5W or D10W.

Cerebral edema: Because of constant IV hydration (via therapy with the consequence of an outflow of water to the brain cells, cerebral edema may develop (more frequent in children).

Pulmonary edema: It is assumed to be secondary to the aggressive resuscitation of fluid. This can be minimized by *shadangodak* as it improved digestion and eliminates risk of Pulmonary edema....

CONCLUSION:

Recent studies that demonstrate therapeutic significance and safety of the DKA in patients with moderate DKA and protocol-based treatment provide new possibilities to reduce the expense of DKA treatment while preserving the quality of clinical results. Resources should also be devoted to education for primary care workers and patients and their families so that symptoms and signs of uncontrolled diabetes may be identified sooner. Following diabetes educational initiatives, better monitoring, and provision of medical guidance, hospitalizations for DKA were decreased often. New methods to patient education, including a range of healthcare attitudes and socio-economic problems, are essential to a successful strategy of prevention. Recent studies that demonstrate clinical value and protection of patients with moderate DKA and protocol-based treatment provide new pathways to reduce the expense of DKA treatment while preserving the quality of clinical results. Resources should also be devoted to educate for primary care workers as well as patients and their families so that symptoms and signs of uncontrolled diabetes may be identified sooner.

Shadangodak helps in achieving the primary goals in the management of DKA. *Shadangodak* is an easily available authentic Ayurveda formulation that offers better option for Oral Rehydration

Solution. so it should be used by physician in the management of DKA patients.

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