Clinical case of late diagnosed diabetes in ketoacidotic coma iii in teenager: lessons to be learned

Abstract

Patient Z, 13 years old, entered the ICU of the Republican Specialized Scientific-Practical Medical Centre of Endocrinology (RSSPMCE) with preliminary diagnosis: Diabetes mellitus newly diagnosed. Diabetic ketoacidotic coma. Concomitant: Left-sided pneumonia. Anamnesis: according to her mother, during the preceding 1.5 months, girl complained of dry mouth, thirst, frequent urination, and weight loss. With complaints of nausea and vomiting, in a precoma state of consciousness 15.01.14 the patient was hospitalized to the infectious hospital, where diabetes was diagnosed; insulin therapy, infusion therapy was started according to the recommendations of endocrinologists consultants, but the patient’s condition progressively worsened, and at 17.01.2014 patient was transferred to the intensive care unit of RSSPMCE.

In the analyzed case, the patient was admitted with extremely severe dehydration, disturbed microcirculation, including violation of renal blood flow, which was reflected in diuresis inadequate to glycemia. Infusion therapy was carried out under strict control of CVP and diuresis, however, CVP was negative during the first two days despite the fact that the volume of administered liquids was 11 liters on the second day, and the daily urine output was 9 L. Nevertheless, in terms of body weight, the speed of infusion therapy was 15 mL/kg/h for the first 24 hours, 11.4 mL/kg/h during the following 24 hours, followed by a decrease to 7-8 mL/kg/hour at the 3rd and 4th days, 6 mL/kg/hour at the day 5. With the elimination of hypovolemia, the volume of intravenously administered solutions decreased, on the fourth day the introduction of fluids through the nasogastric tube was started (with normalization of absorption through GI tract), and on the 5th day feeding was started. The decrease in glycemia during the first day was down to 13 mmol/L, on day 2 - to 7.8 mmol/L. Ketonuria was eliminated by the 2nd day.

Insulin therapy

According to international recommendations, insulin therapy in DKA is performed in a low dose regime at a rate of 0.1 U/kg/h with an increase in the rate of infusion if necessary up to 0.2 U/kg/h. Intramuscular or subcutaneous injection of insulin is ineffective due to impaired absorption (microcirculation disturbance). Intramuscular insulin administration can be used when intravenous insulin therapy is not possible. After stabilization of the level of glycemia, normalization of acid-base balance, restoration of consciousness and stabilization of blood pressure, transfer to subcutaneous injections of insulin is recommended (rapid and long acting insulins). In the analyzed case, the need for insulin during the first day was 0.2 U/kg/hour during the first 6 hours, but as this dose was insufficient, it has been raised to 0.38 U/kg/hr during the 2nd day, 0.1 U/kg/hour for the first 12 hours of the 3rd day, with gradual decrease during the next day to 0.07-0.06-0.04 U/kg/hour (insulin dose is adjusted to the infusions of glucose solutions). Long acting insulin was added on the 6th day of treatment. At the time of discharge, the daily dose of insulin was 13 units (Figure 1). It should be noted that at present, our ICU adheres to the tactics of early initiation of long acting insulin administration. In this case,
the earlier introduction of long acting insulin was impossible due to inadequate microcirculation. There is a clear dependence of the need for insulin on concomitant diseases: at the time of entry–pneumonia, on the 16th day- the development of a right-sided, and on the 19-20th day–bilateral acute purulent otitis media.

iv. Excessively high insulin requirements associated with puberty.

The data on the incidence of ketoacidosis in the literature are based on different calculations: according to Ellemann K, Henriksen O, DKA in Denmark occurs at a frequency of 12.9-120/100000 of the general population. According to Dedov II et al. in Russia the prevalence of DKA is 5-20 per 1000 patients with diabetes. The EURODIAB study conducted in 2006 showed that 8.6% of patients with type 1 diabetes develop DKA. Given the growing prevalence of diabetes, particular attention should be paid to data on the diagnosis of diabetes in a state of ketoacidosis. Thus, according to the data of the Russian Federation, up to 15.3% of diabetic ketoacidotic comas occur in newly diagnosed diabetes. In the US, this figure is 19.9%. The EURODIAB study revealed the dependence of DM manifestation in the state of ketoacidosis on the prevalence of diabetes in the country: in countries with low prevalence of the disease, up to 67% of type 1 diabetes was diagnosed in DKA, whereas in countries with high prevalence DM was revealed in DKA only in 26%. This fact shows the alertness of not only local doctors, but also of the entire population. In 2012, 30% of patients admitted to our ICU with DKA were patients with newly diagnosed disease, 10% of them were admitted in comatose state. We found the same tendency also in 2013-2016:25-33% of hospitalized patients had newly diagnosed diabetes (34-39% of hospitalized children), about 10% of patients with diabetes were in comatose state on admission. The mortality rate for DKA is 4.4-7.6% depending on age: 15% among patients over 70 years and 2% among patients younger than 70 years. According to the Russian Federation, the death rate in DKA is 5-15%, exceeding 16% for coma. According to Indian researchers, 2.5 to 9% of DKA is fatal. There are 202-299 patients hospitalized per year with DKA to our ICU. Of these, there were two fatal cases in 2012 of a child N. of 3 years and in 2015 of a child M. aged 8 years within the first 24 hours from the moment of hospitalization. Both children had newly diagnosed diabetes, were hospitalized in coma III, with brain swelling. Child N. had bilateral pneumonia (virological study showed parainfluenza 3 type +++). Autopsy showed severe degeneration of parenchymal organs. Child M had disseminated tuberculosis, myocarditis and multiple organ failure by the moment of admission.

So, in both cases, the cause of death was late admission, late treatment and severe concomitant diseases.

To conclude, in order to improve timely diagnostics and adequate therapy, it is necessary to have an urgent emergency determination of glycaemia for all patients entering hospitals with complaints of thirst, dry mouth, nausea, vomiting, dyspnea, and/or tachycardia. It is essential (and is already being done) to organize active postgraduate training of all doctors of intensive care and resuscitation departments in tactics of DKA management. Unified standards of DKA management should be and are at the stage of implementation all over the Republic.

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Conflict of Interest

The author declares no conflict of interest.

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