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A case of fulminant type 1 diabetes associated with acute renal failure

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Abstract

A 56-year-old man suffered from severe diabetic ketoacidosis which was complicated by acute renal failure and rhabdomyolysis. Before admission the patient had had flu-like symptoms for 5 days and had developed polyuria and polydipsia. The clinical examination on admission showed his plasma glucose level was 80.65 mmol/L while the HbA1c was 7.4%. His amylase concentration was high without any signs of pancreatitis. The islet-associated autoantibodies (GAD antibody, islet cell antibody) were absent. These data were compatible with the diagnosis of fulminant type 1 diabetes. A continuous intravenous insulin infusion therapy was given during the acute phase to control hyperglycemia and ketoacidosis. This patient remained dependent on continuous veno-venous hemofiltration (CVVHF) for 5 days, followed by regular kidney dialysis for three times, before his renal function was finally recovered. To conclude, this is a rare case of abrupt onset fulminant type 1 diabetes with the onset of acute renal failure. Hence, early detection, quick diagnosis and immediate treatment are very important. In particular, prompt CVVHF and kidney dialysis are required and useful for rescuing the renal function.

CASE REPORT

INTRODUCTION

Type 1 diabetes consists of type 1A and type 1B diabetes, which may be caused by autoimmune and non-autoimmune mechanisms respectively (Expert Committee on the Diagnosis and Classification of Diabetes Mellitus 1998). Fulminant type 1 diabetes (FT1DM) is a novel clinical entity, characterized by an extremely abrupt onset of the disease and remarkably acute destruction of pancreatic beta cells with urinary C-peptide secretion less than 10 μg/day, and more than 90% of FT1DM patients are adolescents or adults (Imagawa *et al.* 2000). FT1DM is basically classified into type 1B diabetes as indicated by absence of islet-related autoantibodies, significantly abrupt onset, severe metabolic disorder and high pancreatic enzyme concentrations.

Herein, we report a 56-year-old patient of an acute renal failure secondary to rhabdomyolysis associated with fulminant type 1 diabetes.

CASE

A 56-year-old male was sent to the First Affiliated Hospital of Anhui Medical University with diabetic ketoacidotic coma in March 2014. He had suffered from intolerance of cold, muscular stiffness and vomiting, accompanied by polyuria, polydipsia and low-grade fever for 5 days before admission. He drank a copious amount of sweetened beverage. He was given drugs for the common cold by a local hospital, but unfortunately his condition worsened. The patient did not have histories of chronic diseases, trauma, infections, drug use. Nor is he exposed to toxins, Moreover, he did not have a familial history of diabetes, All the above information was confirmed by his family.

Physical examination on admission showed that his skin was dry to dehydration and his breath was deep and laborious but no rales were heard. The results of his physical examination were shown in the following: 1. blood pressure: 110/60 mmHg; 2. pulse rate: 120 beats per minute; 3. temperature: 38.5 °C. The results from neurological examinations were negative. The systemic examination displayed unremarkable results. The laboratory results were shown in Table 1. The urine analysis detected glucose (++++), and ketone (++). The arterial blood gas analysis revealed that his pH value was 7.304, his random blood sugar was 80.65 mmol/L and the HbA1c level was 7.4%. The biochemical analysis indicated the CPK concentrations were more than 80 times above the normal range and 60 times of that of CK-MB levels. His hepatorenal function deteriorated gradually, The peak serum creatinine concentrations were 4 times more than the normal range.

The brain computed tomography (CT) showed no abnormal finding. No morphological change of pancreas in the abdominal CT scan indicated that the diagnosis of coexisting acute pancreatitis (Nair *et al.* 2000) was unlikely in spite of high levels of serum amylase. The chest CT showed a little inflammation of the inferior lobe of bilateral lungs. The electrocardiogram showed sinus tachycardia. The diagnosis of DKA coma and renal failure due to rhabdomyolsis was confirmed.

After admission, the aggressive fluid infusion, antibiotics and intensive insulin therapy were initiated, and the patient condition began to improve. The ketoacidosis disappeared after 3 days, and his plasma glucose level was normalized after 4 days. However, the inter- and intra-day glucose variability was relatively high. The patient was resuscitated from 72 h coma little by little. He was found to have reddish-brown urine followed by oligurea after 2 days in hospital, and he remained dependent on continuous veno-venous hemofiltration (CVVHF) for 5 days, followed by receiving regular kidney dialysis for three times. The CPK, CKMB and LDH returned to the normal level and his renal function was normalized (Table 2). The patient began to have urine on the 15th Day, The patient remained in polyuria stage on the 22nd day. His urine volume became normal after treatment on the 36th day. The patient presented with symptoms of left-sided pneumothorax on the 30th day. The left lung self restored 7 days after pneumothorax drainage procedure. The patient switched to insulin injection at discharge: three preprandial injections of insulin aspart at breakfast, lunch, and dinner and one injection before bedtime with insulin glargine. The patient was discharged on the 39th day.

Five months after the abrupt onset of diabetes, the C-peptide releasing test found the following: 0 hr<0.1 ng/ml, 1/2 hr<0.1 ng/ml, 2 hr<0.1 ng/ml and HbA1c 10.40% (4–6%). His renal and hepatic function tests became normal. The CPK, CKMB and LDH were normal.

DISCUSSION

Fulminant type 1 diabetes mellitus is a novel subtype (idiopathic type 1B) proposed by Imagawa *et al.* (Nair *et al.* 2000). Criteria for definite diagnosis of fulminant type 1 diabetes mellitus are [1] the extremely abrupt onset (around 7 days) with the presence of ketoacidosis at diagnosis, [2] plasma glucose level≥16.0 mmol/L and HbA1c<8.5% at the first visit, [3] elevated serum pancreatic enzyme levels, [4] preceding flu-like symptoms (Imagawa & Hanafusa 2006). Since clinical features and diagnosis of this case reported were conformed to the above criteria. According to the nationwide survey data from Japan (Imagawa *et al.* 2003), FT1DM accounts for about 20% of the ketosis-onset type 1 diabetes cases in Japan and has more severe metabolic derangement than in autoimmune type 1 diabetes (Imagawa *et al.* 2003). Severe derangement of serum electrolytes and loss of consciousness are more frequent. The mechanism underlying the development of F1DM is still unclear. It may be related to genetic susceptibility (Imagawa *et al.* 2005), autoimmunity (Shimada & Maruyama 2004) and viral infection (Imagawa *et al.* 2005). In this case, the hyponatremia and acute renal failure are prominent, which might be associated with rhabdomyolysis. In the meantime, the concentrations of potassium and blood calcium in serum are normal. The elevated level of pancreatic enzymes is one of the features of fulminant type 1 diabetes mellitus. Although accumulation of pancreatic enzymes might occur in patients with renal failure (Iyoda *et al.* 2003), the level of amylase is very elevated in our patient (amylase 2.6 times). Hence, we infer that augmentation of the amylase might be due to fulminant type 1 diabetes mellitus.

Rhabdomyolysis, associated with diabetic ketoacidosis, is one of the main causes of the acute renal failure in the patient. Several conditions, including hypernatremia, high blood glucose level, hyperosmolar state and

Tab. 1. Relevant laboratory data on admission and during hospitalization.

Items		Reference range	Items		Reference range
Urinalysis			Blood chemistry		
pH	5.0	4.8~8.0	K (mmol/L)	4.07	3.50~5.50
Pro	(++)		Na (mmol/L)	127.3	135.0~147.0
Glu	(++++)		Ca (mmol/L)	2.11	2.03~2.67
Ketone	(++)		Lactic acid (mmol/L)	2.20	0.70~2.10
OB	(+++)		Lipase (μ/L)	82	23~300
Urob	(±)		BNP (pg/ml)	732	0~100
RBC	15/μl		Amylase (μ/L)	260	20~110
WBC	95/μl		Glu (mmol/L)	80.65	3.89~6.11
Casts	(–)		CPK (μ/L)	5358	26~174
Bil	(–)		CKMB (μ/L)	242	0~24
Myoglobin	100 ng/ml >2 500 (day 2)		ALT (μ/L)	56	5~40
Hemogram			AST (μ/L)	113	8~40
RBC($\times 10^{12}$/L)	4.46	4.30~5.80	LDH (μ/L)	920	
Hb(g/L)	133	130~175	BUN (mmol/L)	25.30	3.20~7.10
Ht(%)	40.20	40.00~50.00	CRE (μmol/L)	251	38~174
WBC($\times 10^9$/L)	9.53	3.50~9.50	Troponin (ng/ml)	0.520	0.000~0.034
NEUT(%)	88.94	40.00~75.00	Immunological data		
Plt($\times 10^9$/L))	109	125~350	GAD-Ab	(-)	
Blood gas		7.350~7.450	IAA	(-)	
pH	7.304	83.20~108.30	ICA	(-)	
paO_2 (mmHg)	125.90	35.0~45.0	TG-Ab	(-)	
pCO_2(mmHg)	31.10	22.0~31.0	TPO-Ab	(-)	
HCO_3^- (mmol/l)	15.6	–3.0~3.0	ANA	(-)	
BEb(mmol/l)	–9.2		c-ANCA	(-)	
Metabolic data			ASMA	(-)	
HbA1c	7.4%		AMA-M_2	(-)	
Fasting C-peptide (ng/ml)	<0.1				
Postprandial C-peptide(ng/ml)	<0.1				

Tab. 2. Clinical course.

	Day 1	Day 2	Day3	Day 4	Day 5	Day 10	Day 21	Day 29	Day 39
Amylase (μ/L)	260	496	304	198	144	72			
CPK (μ/L)	5358	14400	14551	8000	6537	301	98		
CKMB (μ/L)	242	978	1475	511	178	24	46		
ALT (μ/L)	56	147	498	486	385	114	55	33	
AST (μ/L)	113	560	1262	680	503	55	58	35	
LDH (μ/L)	920	1605	4682	4290	1927	911	553	292	
BUN (mmol/L)	25.30	25.40	20.74	20.69	23.16	19.5	14.59	10.10	8.77
CRE (μmol/L)	251	248	456	492	532	709	377	151	97

elevated intracellular sodium concentration resulting from impairment of the Na-K pump function due to the lack of insulin, seem to induce rhabdomyolysis in diabetic patients (Singhal *et al.* 1991)**.** Infection, especially those with virus origins have been thought to be potential causes for both conditions (rhabdomyolysis and fulminant type 1 diabetes mellitus), and flu-like symptoms are more frequently observed in FT1DM (Imagawa & Hanafusa 2006). In this case, moderate-grade fever increased leukocyte counts and neutrophil number indicate infections. It was not confirmed whether the infection is a link between the two conditions (rhabdomyolysis and fulminant type 1 diabetes mellitus). But an earlier case report does demonstrate the association of the infection with rhabdomyolysis (Berger & Wadowksy 2000).

The etiology and mechanism of pneumothorax are not fully understood in the patient. Hung.*et al.* (Hung *et al.* 1995) once reported that a case received a catheter placements for requiring acute haemodialysis and presented with pneumothorax. Our patient recovered a week later.

In conclusion, this case highlights the importance of an early diagnosis to minimize the risk of complications. Treatment of the patient must be started immediately, especially prompt CVVHF and kidney dialysis are required and useful for rescuing the renal function. Otherwise, the disease would quickly deteriorate. The CK levels are not routinely tested in patients because they seldom develop myocardial ischemia. The situation of rhabdomyolysis associated with FT1DM may be overlooked. Hence, CK testing should not be overlooked in FT1DM.

Conflict of interest:*The authors report no conflictst. The authors alone are responsible for the content and writing of this article.*

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