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Awareness of Parents Regarding DKA Symptoms in their Children with Type I DM

Nazim Faisal Hamed [a#], Manal Mohammed E. Alhawiti [b*], Eman Hamed A. Albalawi [b], Lena Defallah G. Alzahrani [c≡], Raghad Mohammed E. Alhawiti [c≡], Sahar Yahya S. Alatawi [cω], Maram Atallah M. Albalawi [cω], Bashaier Musslum M. Albalawi [d], Alanoud Abdullah M. Alzahrani [d], Maram Saleh Ahmed Alsayed [c≡], Yassmeen Hmoud S. Alblowi [cω], Ziad Saleh D. Albalwi [c≡] and Khaled Abdullah S. Alasmari [c≡]

[a] Maternity & Children Hospital, Tabuk, Saudi Arabia.
[b] General Practice, Pediatric Department of Maternity & Children Hospital, Tabuk, Saudi Arabia.
[c] University of Tabuk, Saudi Arabia.
[d] General Practice, King Khaled Hospital, Tabuk, Saudi Arabia.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Diabetic ketoacidosis (DKA) is a common emergency and life-threatening illness. Also, if not detected early, early treatment in the emergency room can cause serious complications. The goal of managing type 1 diabetes is to maintain the correct levels of blood sugar, glycated hemoglobin (HbA1c), blood pressure, lipid levels, and body weight while avoiding hypoglycemia. Treatment of type 1 diabetes requires proper insulin treatment, proper nutrition, physical activity, preventive education, and patient self-care Objective: The purpose of this study is to determine parental perceptions of DKA symptoms in children with type 1 diabetes in the Northern Region of Saudi Arabia.

[#] Consultant General Pediatric;
[≡] Medical Student;
[ω] Medical Intern;
**Corresponding author: E-mail: Dr.manal1955@gmail.com;*

Methods: In the Northern Region of Saudi Arabia, a cross-sectional study was conducted from November 2020 to May 2021 among parents with diabetic children at the Diabetes Center in the Northern Region of Saudi Arabia using a pre-designed online questionnaire distributed on social media web-sites to collect data. Data was analyzed by using statistical package for the social sciences (SPSS, version 23) and results was presented by tabular and graphical presentation according to the study objectives.

Results: only 42.9% of our participants responded that they have good knowledge about DKA. 19.2% thought it only occurs in children. 43.3% of our participants knew that DKA is a complication of diabetes due to hyperglycemia. Regarding the source of information about DKA among our participants, our data demonstrated that only 22.9% of our participants got their information about DKA from the doctors, and 31.8% of the participants had the internet as their source of information regarding DKA. In the current study, 14% of the participants said that they had a child had DKA at least one, and 91.6% of them were admitted to the hospital. There was a significant relation with gender, age of the parent, and educational level, while it showed insignificant relation with marital status.

Conclusion: In conclusion, knowledge of most of parents of diabetic children about diabetic ketoacidosis is poor. Their main knowledge source is not trustful or adequate. Their main knowledge source is not trustful or adequate. Therefore, we recommend policy makers to held health education to parents and/or caregivers of type 1 diabetic children regarding all aspects of DKA. It must be properly achieved in a structured manner based on a general outline that should include education at the onset of treatment and then repeated based upon an annual assessment of patients' training needs or upon their own request. Areas of poor knowledge related to diabetes and diabetic ketoacidosis should be emphasized during health education sessions.

Keywords: Knowledge; parents; type I diabetes; diabetic children; diabetic ketoacidosis.

1. INTRODUCTION

Diabetic ketoacidosis (DKA) is the most common cause of death and morbidity in diabetic children (T1D) [1]. The description of ketoacidosis varies from person to person. Doctors often use ketoacidosis to describe the severity of the condition, while others use it as a synonym for coma. The three components of hyperglycemia, acidosis, and ketoacidosis are the hallmarks of ketoacidosis [2]. The prevalence of DKA varies. Infections, insulin deficiency, inadequate insulin intake, and recently diagnosed diabetes are both risk factors for DKA. Almost a quarter of all ketoacidosis cases occur at the onset of diabetes [3].

The goal of managing type 1 diabetes is to maintain the correct levels of blood sugar, glycated hemoglobin (HbA1c), blood pressure, lipid levels, and body weight while avoiding hypoglycemia. Treatment of type 1 diabetes requires proper insulin treatment, proper nutrition, physical activity, preventive education, and patient self-care [4]. The diverse physical, developmental, and emotional needs of children and their families require intensive treatment to achieve the best long-term results [5]. The clinical manifestations of DKA usually progress rapidly within 24 hours. Some signs, such as polyuria, polydipsia, and weight loss, may appear days before DKA begins. Vomiting and abdominal pain are common early symptoms [6]. Parental expertise is also essential for the treatment of childhood diabetes. Well-educated parents train their children better, as opposed to uneducated parents [7]. If the child's parents are well-educated about diabetes, follow the principles of the day of illness by identifying signs and symptoms of DKA, increasing insulin doses, and increasing fluid intake before going to the emergency room. You need to be treated at home. This has been shown to minimize DKA complications. Newly diagnosed children with DKA require short-term hospitalization to control associated metabolic disorders and initiate insulin therapy [8].

A cross-sectional study was conducted on 385 parents of T1DM children to assess the parental knowledge of type 1 diabetic (T1DM) children with diabetic ketoacidosis. 37.9% of parents had little knowledge of DKA. The greatest lack of knowledge was about the normal range of fasting and postprandial blood glucose levels, the causes of DKA, the normal range of HbA1c, and when a child should see a doctor. Little knowledge of parents was associated with being a father, over 40 years old, poorly educated, unemployed, and earning less than 5000 SR per month [9].

In another study in the Aseer region of Saudi Arabia, learning about mothers' knowledge, awareness, children's knowledge of DKA symptoms, and how to respond to emergencies, 67% of parents know what DKS is. I understand. Diabetes health educators provided information to 48.6%, doctors provided information to 41%, and the internet or media provided information to 15%. 68% of patients had previously had episodes of DKA. A maternal reaction or intervention was reported. It was found that 67% went directly to the hospital, 27% were in an emergency only when the situation worsened, and 20% increased their insulin dose [10].

1.1 Objective

The aim of this study is to determine the awareness of parents regarding the DKA symptoms in their children with type1 DM in the Northern region, Saudi Arabia.

2. METHODOLOGY

2.1 Study Design, Setting

A cross-sectional study conducted in the northern region, Saudi Arabia during the period from 1 October to 30 November 2021 on the parents accompanying their diabetic children 6- 14 years old to the Diabetes Centers of northern region, Saudi Arabia.

2.2 Sample Size

The sample size was calculated by using sample size equation through the following formula

$(N=(Z\alpha)2 \times ([p(1-p)]/d2)$

Where:
n = estimated sample size.
Zα at 5% level of significance = 1.96
d = level of precision and is estimated to be 0.05
p = High awareness levels in two previous studies (30%).

Actual sample size = (Primary sample size × design effect (estimated to be 1.5) considering target population more than 10 000, and study power 95%.
So, the calculated minimum sample size was:

$n = (1.96)2 X 0.50 X 0.50/(0.05)2 = 384$

After adding 10% to guard against the incomplete questionnaires, the sample size will be 420 participants.

2.3 Inclusion Criteria and Exclusion Criteria

The study included all Saudi parents of diabetic children, who aged between 18 and 60 years were included in the study. Non-Saudi subjects, older than 60 or younger than 18 years, were excluded.

2.4 Data Collection

Data was collected using online disseminated questionnaire, which was sent to the general population of the northern area through the social media as WhatsApp, tweeters and Facebook and filling the questionnaire and awareness data was obtained. The questionnaire included questions about sociodemographic characters of participants such as (age, marital status, educational level, working status), questions about the awareness about awareness of parents regarding the DKA symptoms in their children with type1 DM such as (definition of diabetic ketoacidosis, diabetic ketoacidosis a complication of diabetes due to high blood sugar, the source of your information on diabetic ketoacidosis, maintaining a regular blood glucose level prevents diabetic ketoacidosis, diabetic ketoacidosis is dangerous and potentially fatal, diabetic ketoacidosis only occurs in young people, and having any children had diabetic ketoacidosis before.

2.5 Pilot Study

A pilot study was conducted on 20 respondents before the beginning of the study period to determine the applicability and adequacy of the questionnaire, further additional modifications was done after testing, and the questionnaire was re-administered.

2.6 Data Management

Data was analyzed by using statistical package for the social sciences (SPSS, version 23) and results was presented by tabular and graphical presentation according to the study objectives.

3. RESULTS

Table (1) shows the socio-demographic characteristics of the participants. Our participants were 37.5% males and 62.5% females. 32% of the respondents were between 31 – 40 years old, 28.5% were between 41 – 50

years old, and only 6.4% were more than 60 years old. 55.3% had university degree and 88.2% were married.

Table (2) shows the awareness of the participants about diabetic ketoacidosis (DKA), only 42.9% of our participants responded that they have good knowledge about DKA. 19.2% thought it only occurs in children. 43.3% of our participants knew that DKA is a complication of diabetes due to hyperglycemia. Regarding the source of information about DKA among our participants, our data demonstrated that only 22.9% of our participants got their information about DKA from the doctors, and 31.8% of the participants had the internet as their source of information regarding DKA. In the current study, 14% of the participants said that they had a child had DKA at least one, and 91.6% of them were admitted to the hospital.

Table (3): Illustrates the relation between knowledge about DKA with sociodemographic characteristics of participants. It shows a significant relation with gender, age of the parent, and educational level, while it showed insignificant relation with marital status.

4. DISCUSSION

DKA is one of the most common medical emergencies and life-threatening condition; specially if not recognized early, with early management in emergency department, may lead to grave complications. Pediatric type-1 diabetic patients are especially vulnerable to such metabolic conditions. During this period, mothers of pediatric type-1 diabetics should pay special attention focusing management of diabetes at home with increased hydration and insulin dose. Hence, hyperglycemic crisis and development of DKA can be prevented by good education about diabetes, for both the patient and parents [11,12].

Despite the progress in diagnosis and treatment of type 1 diabetes, diabetic ketoacidosis (DKA) is still one of most serious clinical problems. Many reports on the incidence of diabetic ketoacidosis (DKA) in Saudi Arabia at the onset of type 1 diabetes mellitus (T1DM) in children have been published recently. Large number of cases was reported in many diverse previous studies. A new large retrospective chart review was conducted during the period 2005-2015 studied the initial

Table 1. Sociodemographic characteristics of participants (n=515)

Parameter		No.	Percent
Gender	● Male	193	37.5
	● Female	322	62.5
Age of the parent who filled out the questionnaire	● 20 - 30 years old	84	16.3
	● 31 - 40 years old	165	32.0
	● 41 – 50 years old	147	28.5
	● 51 - 60 years old	86	16.7
	● More than 60	33	6.4
Marital status	● married	454	88.2
	● divorced	38	7.4
	● widow	23	4.5
Education level	● uneducated	14	2.7
	● primary	33	6.4
	● middle	38	7.4
	● secondary	145	28.2
	● University and above	285	55.3

Table 2. Knowledge of participants (n=515)

Parameter		No.	Percent
Having good knowledge about diabetic ketoacidosis for diabetics	● Yes	221	42.9
	● No	294	57.1
Diabetic ketoacidosis a complication of diabetes due to hyperglycemia	● Yes	223	43.3
	● No	36	7.0
	● I don't know	256	49.7
Source of information about diabetic ketoacidosis	● Internet	164	31.8
	● friends	84	16.3
	● the doctor	118	22.9
	● relatives	76	14.7
	● A pharmacist	23	4.4
	● All of the above	162	31.4
Maintaining a regular blood glucose level protects against diabetic ketoacidosis	● Yes	316	61.4
	● No	23	4.5
	● I don't know	176	34.2
Diabetic ketoacidosis is dangerous and may cause death	● Yes	236	45.8
	● No	40	7.8
	● I don't know	239	46.4
Diabetic ketoacidosis only occurs in young	● Yes	99	19.2
	● No	186	36.1
	● I don't know	230	44.7
Symptoms of diabetic ketoacidosis	● Dizziness	227	44.1
	● Abdominal pain	172	33.3
	● vomiting	144	27.9
	● Blurred vision	138	26.7
	● Unconsciousness	162	31.4
	● Rapid and deep breathing	127	24.6
One of your children ever had diabetic ketoacidosis	● Yes	72	14.0
	● No	443	86.0
If the answer is yes, was he detained in the hospital	● Yes	66	91.6
	● No	249	345.8

Right thing to do if one of your children has diabetic ketoacidosis and has symptoms	● Call an ambulance immediately	357	69.3
	● Give him an extra dose of insulin	64	12.4
	● Give him juice or something that contains sugar	61	11.8
	● I do not know	31	6.0
	● Other	81	15.7
From your point of view, there is enough awareness in your city about diabetic ketoacidosis and the correct action regarding it	● Yes	80	15.5
	● No	275	53.4
	● I don't know	160	31.1

Table 3. Illustrates the relation between knowledge about DKA with sociodemographic characteristics of participants

		Good knowledge about DKA		Total	P
		Yes	No	(N=515)	value
Gender	Male	62 28.1%	131 44.6%	193 37.5%	0.001
	Female	159 71.9%	163 55.4%	322 62.5%	
Age of the parent who filled out the questionnaire	20 - 30 years old	39 17.6%	45 15.3%	84 16.3%	0.010
	31 - 40 years old	79 35.7%	86 29.3%	165 32.0%	
	41 – 50 years old	65 29.4%	82 27.9%	147 28.5%	
	51 - 60 years old	33 14.9%	53 18.0%	86 16.7%	
	More than 60	5 2.3%	28 9.5%	33 6.4%	
Marital status	married	201 91.0%	253 86.1%	454 88.2%	0.228
	divorced	12 5.4%	26 8.8%	38 7.4%	
	widow	8 3.6%	15 5.1%	23 4.5%	
Education level	uneducated	3 1.4%	11 3.7%	14 2.7%	0.020
	primary	13 5.9%	20 6.8%	33 6.4%	
	middle	15 6.8%	23 7.8%	38 7.4%	
	secondary	50 22.6%	95 32.3%	145 28.2%	
	University and above	140 63.3%	145 49.3%	285 55.3%	

DKA incidence at King Abdulaziz Medical City - Jeddah. They have found that the incidence of DKA among those who are newly diagnosed as T1DM pediatric patients was 37.8%, which is a high percentage [13].

The aim of the study was to describe the awareness level of the parents regarding the DKA symptoms in their children with type1 DM in Aseer region, Saudi Arabia.

Despite DKA is a serious emergency condition which needs a very fast and good emergency behavior from the relatives and a good general background about such a case, health education of the relatives about DKA is very essential for better management of diabetes at home [14,15]. To evaluate the patient or their parents' knowledge is an important aspect of diabetes health education [16,17].

In this study, our participants were 37.5% males and 62.5% females, only 42.9% of our participants responded that they have knowledge about DKA. This was alarming sign and requires many programs of health education about DKA at national levels in Saudi Arabia. This percentage is less than that was recorded by Abdullah Othman. Et al. in the same region in 2018 [18], 2.7% of their total participant were illiterate, while 55.3% mothers completed university level education. However, 57.1% reported that they do not know what is DKA.

These results may shows that there is no important relationship between educational level and knowledge level of the parents about DKA.

Manal Ali Alhomood. et al. [19], showed that participant parents of type1 diabetic children had suboptimal knowledge regarding diabetes and diabetic ketoacidosis. About half of parents had good knowledge.

Their main knowledge deficits were related to complications of diabetes, symptoms, enough awareness, there is only19.2% thought it only occurs in children, however, 43.3% of our participants knew that DKA is a complication of diabetes due to hyperglycemia.

Regarding the source of information in table-2, our data also demonstrated that 31.8% got information from internet and 22.9% of them from doctors as a source of information regarding DKA. Although media and internet can play an important role, however, role of physicians and educators should be more specific and important, this is in contrary with Abdullah Othman. Et al.s' results.

In the current study, 14% of the participants said that they had a child had DKA at least one. This is unlike the results of another previous studies. [19] They have found that almost two-thirds of diabetic children were previously hospitalized for the complications of diabetes, mostly several times. However, this finding is in harmony with the results obtained in Nigeria, by Onyiriukaet al. [20], they have reported that about three-quarters of type1 diabetic pediatric patients had presented with diabetic ketoacidosis.

On the other hand, Al-Hayek et al. [21], in Saudi Arabia, found that almost all their adolescent type 1 diabetic patients had experienced diabetic ketoacidosis, while only 54.4% of them experienced one episode, 5.8% had three episodes of ketoacidosis or more, and 39.8% had two episodes.

Also Zhong et al. [22] found that recurrent diabetic ketoacidosis accounted for a significant portion of the hospitalizations, mainly for type 1 diabetes. Jefferies et al. [23] stated that, worldwide, 12.7–80% of type 1 diabetic patients present with diabetic ketoacidosis as their first presentation of diabetes.

Previous similar study [24] found that improved parents' knowledge about diabetes and its complications is the basis for better control of type 1 diabetic patients; especially children; and is associated with decreased risk of complications comprising DKA.

Diabetes educators should focus on all aspects of diabetes management parameters on each visit, and to follow as well as assessment up periodically.

Diabetes Educators should inform that during the illness never stop insulin therapy, may rise the insulin dose depending on SMBG, diet control as well as frequent self-monitoring of blood glucose level and ketones. And if symptoms persist, or ketones become significant positive, then emergency call is essential to prevent further complications of DKA. [25, 26].

Rosenbauer et al. [27] reported significant improvement in metabolic control and a simultaneous reduction in hypoglycemic events among type 1 diabetic patients (children and adolescents). They explained that this improvement was achieved not only due to the application of modern therapy methods, but also due to improved education methods for both patients and their families and also Vellanki et al. [28], stated that the prevention programs aiming at providing education of parents, pediatricians, and personnel at primary and secondary schools to distinguish symptoms of diabetic ketoacidosis resulted in a significant reduction in the number of cases of children presenting with diabetic ketoacidosis at initial diagnosis of diabetes.

5. CONCLUSION AND RECOMMENDA-TION

In conclusion, knowledge of most of parents of diabetic children about diabetic ketoacidosis is poor. Their main knowledge source is not trustful or adequate. Therefore, we recommend policy makers to held health education to parents and/or caregivers of type 1 diabetic children regarding all aspects of DKA. It must be properly achieved in a structured manner based on a general outline that should include education at the onset of treatment and then repeated based upon an annual assessment of patients' training needs or upon their own request. Areas of poor knowledge related to diabetes and diabetic ketoacidosis should be emphasized during health education sessions.

CONSENT AND ETHICAL APPROVAL

An ethical approval to conduct this study was obtained from the research ethics committee

of Tabuk University. The questionnaire contained a brief introduction to explain the aim of the study to the participants. Participants were informed that participation is completely voluntary. No names will be recorded on the questionnaires. All questionnaires kept safe.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Polskie Towarzystwo Diabetologiczne Zalecenia kliniczne dotyczące postępowania u chorych na cukrzycę 2014. Diabetol Dosw Klin. 2014;2(Suppl. A):A1–70.
2. Kitabchi AE, Fisher JN, Murphy MB, Rumbak MJ. Diabetic ketoacidosis and the hyperglycemic, hyperosmolar nonketotic state. In: Kahn GC, Weir CR, eds. Joslin's Diabetes Mellitus. Lea and Febiger, Philadelphia, 1994;738–747.
3. Lebovitz HE. Diabetic ketoacidosis. Lancet 1995;345:767–771.
4. Iafusco D. Diet and physical activity in patients with type 1 diabetes. Acta Biomed. 2006;77(Suppl. 1):41–6.
5. Pillay J, Armstrong MJ, Butalia S, et al. Behavioral programs for type 1 diabetes mellitus: A systematic review and meta-analysis. Ann Intern Med 2015;163:836–47.
6. Umpierrez GE, Murphy MB, Kitabchi AE. Diabetic ketoacidosis and hyperglycemic hyperosmolar syndrome. Diabetes Spectrum 2002;15(1):28-36
7. Wallace TM, Matthews DR. Recent advances in the monitoring and management of diabetic ketoacidosis. QJM. 2004;97(12):773–780.
8. Clar C, Waugh N, Thomas S. Routine hospital admission versus out-patient or home care in children at diagnosis of type 1 diabetes mellitus. Cochrane Database Syst Rev 2006;(2): CD004099.
9. Manal Ali Alhomood ,Khalid Yahya Shibli ,Safar Abadi ,Ossama A. Mostafa ,Shamsun Nahar , Knowledge about diabetic ketoacidosis among parents of type 1 diabetic children, Middle East J. Fam. Med. 2020;18(1):91-101 .
   Available:https://doi.org/10.5742/MEWFM.2020.93734
10. Othman, Abdullah Awwad, Mohammad Aziz, Kamran Asiri, Sameera alqahtani, Norura. Knowledge and Awareness of Mothers about Diabetic Ketoacidosis among Type-1 Diabetic Children and Their Action and Response in Emergency Conditions in Aseer Region of Saudi Arabia. Journal of Diabetic Complications & Medicine. 2018;03.
    DOI: 10.4172/2475-3211.1000122.
11. Speight J, Bradley C. He ADKnowl: Identifying knowledge deficits in diabetes care. Diabetic Medicine. 2001;18:626-33.
12. Wu YP, Hilliard ME, Rausch J. Family involvement with the diabetes regimen in young people: He role of adolescent depressive symptoms. Diabet Med. 2013;30:596-602.
13. Al Shaikh A, Farahat F, Saeedi M, Bakar A, Al Gahtani A, Al-Zahrani N, Jaha L, Aseeri MA, Al-Jifree HM, Al Zahrani A. Incidence of diabetic ketoacidosis in newly diagnosed type 1 diabetes children in western Saudi Arabia: 11-year experience. J Pediatr Endocrinol Metab. 2019;32(8): 857-862.
    DOI: 10.1515/jpem-2018-0548.
    PMID: 31271557.
14. Keough L, Sullivan-Bolyai S, Crawford S, Schilling L, Dixon J. Selfmanagement of type 1 diabetes across adolescence. He Diabetes Educator. 2011;37:486-500.
15. Noohu Khan AN, Venkatachalam VV, Akhali KM, Alavudeen SS, D Dhanapal CK. Overview of glycemic control, knowledge, awareness and attitude among type-2 diabetes male patient's. J App Pharm. 2015;7:75-82.
16. Charron PD, Fischl AR, Choi J, Schmitt PL, White NH. Motherdaughter dyadic approach for starting preconception counseling at puberty in girls with diabetes. Res J Womens Health. 2014;29:1.
17. Murugesan N, Snehalatha C, Shobhana R, Roglic G, Ramachandran A (2007) Awareness about diabetes and its complications in the general and diabetic population in a city in southern India. Diabetes Res Clin Pract 77:433-437.
18. Othman, et al., J Diabetic Complications Med 2018, 3:2
19. Manal Ali Alhomood. Et al. Knowledge about diabetic ketoacidosis among parents of type 1 diabetic children. World Family Medicine/Middle East Journal Of Family Medicine. 2020;1:18.

20. Onyiriuka AN, Ifebi E. Ketoacidosis at diagnosis oftype 1 diabetes in children and adolescents: frequencyand clinical characteristics. J Diabetes Metab Disord. 2013;12(1):47.
21. Al-Hayek AA, Robert AA, Braham RB, Turki AS, Al-SabaanFS. Frequency and associated risk factors of recurrentdiabetic ketoacidosis among Saudi adolescents with type1 diabetes mellitus. Saudi Med J. 2015;36(2):216-220.
22. Zhong VW, Juhaeri J, Mayer-Davis EJ. Trends in hospitaladmission for diabetic ketoacidosis in adults with type 1 and type 2 diabetes in England, 1998–2013: a retrospectivecohort study. Diabetes Care 2018;41:1870–187.
23. Jefferies CA, Nakhla M, Derraik JG, Gunn AJ, Daneman D, Cut eld WS. Preventing diabetic ketoacidosis. Pediatr Clin North Am 2015; 62:857–871.
24. Araszkiewicz A, Zozulinska-Ziolkiewicz D, Trepinska M, Wierusz-Wysocka B. Knowledge after five-day teaching program in intensive insulin therapy performed at the onset of type 1 diabetes ifiulence the development of late diabetic complications. Diab Res Clin Pract 2008;81: 61-7.
25. D eO L. Sick-day management in type 1 diabetes. Endocrinol Metab Clin North Am. 2000; 4:707-23.
26. Realsen J, Goettle H, Chase HP. Morbidity and mortality of diabetic ketoacidosis with and without insulin pump care. Diabetes Technol Her. 2012;14:1149-1154.
27. Rosenbauer J, Dost A, Karges B, Hungele A, Stahl A,Bächle C, et al. Improved metabolic control in children andadolescents with type 1 diabetes. Diabetes Care 2012;35:80-6.
28. Vellanki P, Umpierrez GE. Increasing Hospitalizationsfor DKA: A Need for Prevention Programs Diabetes Care. 2018;41:1839–1841

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