



Case report

Complementary therapy of traditional Chinese medicine for blood sugar control in a patient with type 1 diabetes

Ming-Huei Cheng^d, Ching-Liang Hsieh^b, Chih-Yu Wang^e, Chin-Chuan Tsai^f,
Che-Chang Kuo (Dr.)^{a,c,*}^a Department of Traditional Chinese Medicine, St. Joseph Hospital, Kaohsiung, Taiwan^b Graduate Institute of Integrated Medicine, China Medical University, Taichung, Taiwan^c School of Chinese Medicine of Post Baccalaureate, I-Shou University, Kaohsiung, Taiwan^d Department of Traditional Chinese Medicine, China Medical University Hospital, Taichung, Taiwan^e Department of Biomedical Engineering, I-Shou University, Kaohsiung, Taiwan^f School of Chinese Medicine for Post-Baccalaureate, I-Shou University, Kaohsiung 82445, Taiwan

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ABSTRACT

Objective: Using a case study to discuss the effects of traditional Chinese medicine (TCM) treatments on Type 1 diabetes mellitus.**Clinical features:** A 4-year-old girl with sudden polyuria and nocturia (fasting plasma glucose level: 270 mg/dL) was diagnosed with type 1 diabetes. Although multiple daily insulin injections were applied, her plasma glucose levels were still unstable. Therefore, she received a complementary TCM therapy by taking modified Liu-Wei-Di-Huang-Wan (3.0 g/day; three times daily) for 3 months. After the treatments, her plasma glucose levels appeared to be more stable. HbA_{1c} 6.5% and insulin injections were reduced to only once a day.**Conclusions:** The results suggest that complementary TCM therapy has the ability to assist some patients with type 1 diabetes mellitus in controlling their plasma glucose levels.

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1. Introduction

Type 1 diabetes is a disorder in which autoimmune destruction of pancreatic β -cells leads to absolute insulin deficiency. This form of diabetes accounts for 5–10% of all diabetes patients.¹ Type 1 diabetes is often diagnosed in children and early adolescents. On average, about 50%–60% patients are younger than 18 years old. American Diabetes Association (ADA) diagnostic criteria for diabetes mellitus^{2,3} include fasting plasma glucose level ≥ 126 mg/dL or 7 mmol/L under no caloric intake for ≥ 8 h, hemoglobin A1c (HbA1c) $\geq 6.5\%$, 2-h plasma glucose ≥ 200 mg/dL (11.1 mmol/L) during a 75-g oral glucose tolerance test (OGTT), or classic symptoms of hyperglycemia or hyperglycemic crisis with a random plasma glucose ≥ 200 mg/dL (11.1 mmol/L). Common symptoms of hyperglycemia include polyuria, polydipsia, blurred vision etc., but marked hyperglycemia is also accompanied by impairment of growth and susceptibility to certain infections

associated with chronic hyperglycemia. Diabetes self-management focuses on glycemic control through measuring HbA1c concentrations. Decrease in HbA1c concentrations is associated with lower risk of onset or progression of complications, such as microvascular diseases (e.g., retinopathy, nephropathy, and neuropathy), and macrovascular diseases (e.g., cardiovascular, cerebrovascular, and peripheral vascular disease etc).⁴

The Diabetes Control and Complications Trial (DCCT) showed that intensive insulin therapy (multiple-dose insulin (MDI) injections (three to four injections of basal and prandial insulin per day), continuous subcutaneous insulin infusion (CSII), or insulin pump therapy) can have positive effects on glycemia and type 1 diabetes.² In this study, therapy was carried out with short- and intermediate-acting human insulins. But in spite of positive microvascular outcomes, intensive insulin therapy was positively associated with severe hypoglycemia. Therefore, glycemic control, patients self-monitoring of blood glucose (SMBG) or interstitial glucose, and A1C, is important.² Three-quarters of all cases of type 1 diabetes are diagnosed in individuals who were younger than 18 years old. Insulin sensitivity changes in children and adolescents with type 1 diabetes because of the following reasons: sexual maturity and physical growth, ability to provide self-care, neurologic

* Corresponding author at: Department of Traditional Chinese Medicine, St. Joseph Hospital, No.352, Jianguo 1st Rd., Lingya Dist., Kaohsiung 80288, Taiwan.
E-mail address: chechang007@gmail.com (C.-C. Kuo).

Table 1
ADA recommendations of plasma blood glucose and A1C goals for type 1 diabetes by age-group.

Age(years)	Plasma blood glucose goal range (mg/dL)		HbA1c
	Before meals	Bedtime/overnight	
0–6	100–180	110–200	8.5%
6–12	90–180	100–180	8%
13–19	90–130	90–150	7.5%

vulnerability to hypoglycemia, and DKA. Therefore, ADA suggested that glycemic goals² need to be adjusted according to age and the risk of developing severe hypoglycemia. Its sequelae also need to be taken into account (Table 1).

Diabetes Mellitus is similar to *Xiaokezheng* in traditional Chinese medicine (TCM), which results from over consumption of yin fluid leading to production of endogenous heat in the body. Therefore, the clearing heat and engendering fluid method is used to treat *Xiaokezheng*.⁵ It has been well documented that many Chinese herbs, such as *Radix Puerariae*, *Radix Ginseng* etc., may have hypoglycemic effects, and the effects may be mediated via multiple pathways including increasing insulin sensitivity or insulin secretion.⁶

TCM is popular in Taiwan. It has been covered by the national health insurance since 1996. According to statistics, more than 60% Taiwanese used TCM between 1996 and 2001 in Taiwan,⁷ and approximately 14.1% used both Chinese herbs and conventional western medicine concurrently.⁸ TCM usage in childhood is about 22%.⁹ This research reported a case of a child with type 1 diabetes who concurrently used TCM and western medicine to improve plasma glucose sugar levels.

2. Case report

A 4-year-old girl, who was a healthy and active child, was found malaise appearance, poor activity, poor attention, nocturnal enuresis, polyuria and polydipsia without polyphagia by her family. On May 26, 2013, her family noted that there were ants around stool-bucket after her urination. Therefore, she was carried to an outpatient department (OPD) of a medical center in Southern Taiwan. Laboratory examinations showed that her plasma blood sugar was 270 mg/dL. Type 1 Diabetes mellitus was diagnosed and she was then hospitalized. The doctor used regular insulin (Actrapid HM Penfill) and NPH (Insulatard HM Penfill) 5U (daytime) (twice injection a day) to control hyperglycemia. The fasting plasma blood sugar levels ranged from 58 to 452 mg/dL during her hospitalized period from May 26 to June 3 2013 (Table 2). She received anti-diabetic treatment by using adjusted doses of regular insulin and NPH injection twice a day in OPD after discharge (Table 3).

She visited our clinic in search of a complementary treatment of TCM for controlling her plasma glucose levels on June 5, 2013.

Table 2
Fasting plasma glucose levels during admission period (mg/dL).

TIME DATE (2013)	3:00	8:00	12:00	18:00	22:00	Insulin Injection	
						12:20	18:30
5/26 5/27	283	120	161	58	236	RI:3U NPH:5U	RI:2U NPH:2U
5/28	198	267	282	217	186	RI:3U NPH:5U	RI:1U NPH:2U
5/29	75	220	124	204	317	RI:3U NPH:5U	RI:1U NPH:2U
5/30	80	298	294	183	89	RI:3U NPH:5U	RI:1UNPH:1.5U
5/31	130	254	60	209	259	RI:3U NPH:5U	RI:1UNPH:1.5U
6/1	452	308(R,9:00)	328	87 (R,19:00)	286	RI:3.5UNPH:6U	RI:1UNPH:1.5U
6/2	343	239	246	115(R,19:00)	124	RI:3.5UNPH:6U	RI:1UNPH:1.5U
6/3	69					RI:3U NPH:6U	RI:1UNPH:1.5U

3:00: 3 am; 8:00: 8 am; 12:00: 12:00 P.M.; 18:00: 6:00 P.M.; 22:00: 10:00 P.M.; insulin injection executed at 12:20 pm and 18:30.
RI: regular insulin; NPH: NPH insulin; R: Random plasma glucose test.

During our four examinations of TCM, the patient appeared to be thin and her lip was reddish color. Her activity was weak and she tended to stay in her mother's arm. Tongue body was tender-soft and red. Tongue fur was thin and white, and most of the furs located on the top of tongue. The pulse was sting-like, quick and soggy. The cubital skin was hot upon touch examination. Together, the patient was categorized as "dual deficiency of qi and yin with internal heat" according to TCM pattern. Thus, the Chinese medical doctor used Liu-Wei-Di-Huang-Wan (3.0 g/day; SUN TEN PHARMACEUTICAL CO.,LTD), a formula of TCM granules, which consists of *Shu-Di-Huang (Radix Rehmanniae Praeparata)*, *Shan-Zhu-Yu (Fructus Corni)*, *Shan-Yao (Rhizoma Dioscoreae)*, *Mu-Dan-Pi (Cortex Moutan)*, *Fu-Ling (Poria)* and *Ze-Xie (Rhizoma Alismatis)*, together with *Huang-Qi (Radix Astragali; SUN TEN PHARMACEUTICAL CO.,LTD)* 0.3 g/day, and *Tian-Hua-Fen (Trichosanthis Radix; SUN TEN PHARMACEUTICAL CO.,LTD)* 0.2 g/day, three times daily, to control her levels of plasma of glucose (Table 4). The serum glucose became acceptable based on plasma blood glucose goal range for type 1 diabetes by age groups, after Liu-Wei-Di-Huang-wan treatment for 23 days (from 5 to June 27, 2014). We can see the frequency of plasma blood glucose over 180 (mg/dL) decline (52%, before TCM treatment, 34.3%, after 7-days TCM treatment, 14.2%, after 14-days TCM treatment, 12.5%, after 22-days TCM treatment). (Table 5) Furthermore, western medical doctors changed regular insulin and NPH injection from twice a day to qd (one time per day) after 11-days TCM treatment, and continued to reduce the dose (Table 3). After 3 month of combined treatment, HbA1c is 6.5% (Table 3).

3. Discussion

Type 1 diabetes is usually associated with premature mortality due to both acute and chronic complications, such as renal complications and cardiovascular disease, in spite of the advances in diabetes care.¹⁰ A decrease in chronic complications of diabetes during the first 20 years of diabetes can help explicate the better survival rate for patients with the early onset (age 0–14 years) type 1 diabetes.

HbA1c $\geq 10.5\%$ ¹¹ was found to be associated with increased risks of heart failure in patients with type 1 diabetes. Also, microalbuminuria¹² was associated with the risk of developing nephropathy. Importantly, both of them will be reduced remarkably with an ideal blood glucose levels control. Therefore, how to control as an ideal blood glucose level is critical. This study also argued that HbA_{1c} levels can be used as an indicator to evaluate the state of blood glucose levels.¹¹ However, despite better microvascular outcomes, intensive insulin therapy was positively associated with the rate of developing severe hypoglycemia. Notably, most children couldn't react to or were unaware of hypoglycemic symptoms. This places them at greater risk of severe hypoglycemia and its sequelae.

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