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Editorial Board Member of *World Journal of Clinical Cases*, Jie-Feng Huang, PhD, Associate Chief Physician, Associate Professor, Department of Orthopaedics and Traumatology, The First Affiliated Hospital of Zhejiang Chinese Medical University, Hangzhou 310006, Zhejiang Province, China. 40983285@qq.com

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Nursing a patient with latent autoimmune diabetes in adults with insulin-related lipodystrophy, allergy, and exogenous insulin autoimmune syndrome: A case report

Fang He, Ling-Ling Xu, Yu-Xiu Li, Ya-Xiu Dong

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Fang He, Ling-Ling Xu, Yu-Xiu Li, Ya-Xiu Dong, Department of Endocrinology, Peking Union Medical College Hospital, Beijing 100730, China

Corresponding author: Ling-Ling Xu, MD, Chief Doctor, Department of Endocrinology, Peking Union Medical College Hospital, Shuaifuyuan Street, Beijing 100730, China. llxuwh@163.com

Abstract

BACKGROUND

Latent autoimmune diabetes in adults (LADA) is a special type of type 1 diabetes mellitus. During the early stages, patients with LADA are treated with oral antidiabetics. However, insulin treatment is still required as islet function gradually declines. Once patients have developed insulin allergy, clinical treatment and nursing care become very challenging.

CASE SUMMARY

Here, we report a case of LADA with insulin-related lipodystrophy, allergy, and exogenous insulin autoimmune syndrome during insulin treatment, thus making it very difficult to effectively control glucose levels with insulin. We attempted subcutaneous injection and an insulin pump to desensitize the patient's response to insulin, and finally assisted the doctor to select the appropriate insulin treatment for the patient. We describe the management of this patient from a nursing viewpoint.

CONCLUSION

We summarize the nursing experience of a case with complex insulin allergy requiring desensitization treatment. Our approach is very practical and can be applied to similar patients needing insulin desensitization.

Key Words: Insulin allergy; Desensitization; Lipodystrophy; Exogenous insulin autoimmune syndrome; Skin test; Nursing; Case report

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Core Tip: Latent autoimmune diabetes in adults (LADA) patients will have a need for exogenous insulin eventually. Once patients have developed insulin allergy, clinical treatment and nursing care become very challenging. We report a case of LADA with insulin-related lipodystrophy, allergy, and exogenous insulin autoimmune syndrome during insulin treatment. We successfully assisted the doctor to select a suitable form of insulin for timely skin testing and desensitization treatment. We describe the management of this patient from a nursing viewpoint. Here, we summarize the nursing experience of a case with complex insulin allergy requiring desensitization treatment.

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INTRODUCTION

Insulin allergy belongs to a special type of allergy to protein drugs; most cases involve type 1 allergy. The clinical manifestations of insulin allergy can be divided into local manifestations and systemic manifestations. Local manifestations mainly refer to wheals which is injection point centered, sometimes pseudopodia, and the injection point can be very itchy. Systemic manifestations include urticaria, asthma, and anaphylactic shock[1]. Although systemic effects are rare, this condition can be life-threatening and needs to be managed carefully.

Insulin plays a very important role in the treatment of diabetes. For patients with type 1 diabetes, insulin therapy is an irreplaceable treatment option for those with both acute and chronic complications of diabetes[2]. Latent autoimmune diabetes in adults (LADA) is a special type of type 1 diabetes. During the early stages of LADA, patients are treated with oral antidiabetics. However, insulin treatment is still required as the function of the islets gradually deteriorates[3]. Therefore, it is very important to select a suitable form of insulin for timely skin testing and desensitization treatment. The key to successful desensitization is the desensitization technology utilized, the experience of the nursing staff, and the psychological care that is provided to the patients.

In October 2014, a case of insulin allergy was treated at our department. Prior to admission, the patient had experienced an allergy during the use of insulin at another hospital. The patient also experienced insulin-related lipodystrophy and exogenous insulin autoimmune syndrome. Finally, insulin was successfully used to control glucose levels. Herein, we describe the treatment and nursing of this particular case.

CASE PRESENTATION

Chief complaints

A 34-year-old male patient presented with a history of diabetes for 2 years and rashes at the insulin injection site accompanied by lipodystrophy.

History of present illness

The patient had a 2-year history of diabetes. Fasting blood glucose fluctuated between 8 and 12 mmol/L. Due to poor glucose control, the patient began to use insulin therapy in May 2014 at another hospital. Insulin therapy involved subcutaneous injections of Novolin R (18 IU, 8 IU, and 16 IU) and Novolin N (10 U). Under this form of treatment, the patient's glucose levels were well controlled. After 4 months of insulin injections, pruritus, wheals, and subcutaneous induration began to appear at the injection site, and became gradually aggravated over time. In response to these symptoms, the patient was administered with oral hypoglycemic therapy. The specific formula was Metformin (0.5 g BID) and Voglibose (0.2 mg QD). Initially, blood glucose control was relatively good. However, there was an increase in glucose with fasting blood glucose at 10 mmol/L. An insulin pump was started and the levels of glucose were well controlled. During the course of insulin treatment, pruritus, rash, and subcutaneous induration re-appeared at the injection site which was accompanied by lipodystrophy. The patient was referred to our hospital for further investigation and treatment.

Personal and family history

The patient's brother suffered diabetes.

Physical examination

The physical examination revealed some rashes and lipodystrophy in the skin.

Laboratory examinations

Total IgE was 26.6 KU/L (0-60), protamine specific IgE was 0.03 KUA/L (grade 0), pig insulin specific IgE was 10.1 KUA/L (level 3), cattle insulin specific IgE was 3.77 KUA/L (grade 3), and human insulin specific IgE was 4.25 KUA/L (grade 3).

FINAL DIAGNOSIS

The patient was diagnosed with LADA, insulin allergy, insulin-related lipodystrophy, and exogenous insulin autoimmune syndrome.

TREATMENT

On the second day of admission, the patient was administered with nine different forms of insulin for the allergy test: Pig insulin, Humulin N, Novolin N, Humulin R, Novolin R, Humalog, Novorapid, detemir, glargine, and 0.9% saline. Red swelling or induration was smallest with detemir, Novolin R, or Humalog (Table 1, Figure 1). Insulin desensitization was started. First, the patient was treated with Humalog for desensitization. However, the patient still suffered from subcutaneous nodules, pruritus, and rashes with red halo at the injection site. Then the patient switched to be desensitized with Novolin R with success. Subcutaneous injections of Novolin R 6 U, 4 U, and 4 U were administered before three daily meals, and detemir insulin 4 U was administered before sleep, along with oral pioglitazone (15 mg QD). The patient had a mild allergic reaction while the subcutaneous nodes were soft and disappeared after a few hours without any other discomfort such as redness and itching. Ebastine was added with the allergic reaction further improved.

OUTCOME AND FOLLOW-UP

The patient was followed for more than 5 years. He continued to be treated with Novolin R and detemir at the same dosage and well-controlled blood glucose. Ebastine was also continued. The allergic reaction was not significant. We also provided systematic diabetes education for the patient and he was taught to change the insulin injection site and needle each time.

Main points of nursing care prior to desensitization

Continuous psychological care: The patient rapidly developed local manifestations such as subcutaneous nodules, pruritus, wheals, and redness after insulin injection. We planned to carry out skin tests with nine types of insulin preparations for the patient; each preparation may have induced different degrees of allergic reaction. In view of the patient's previous allergic reaction to insulin, the patient became fearful prior to desensitization. Before the desensitization treatment, we communicated with the patient several times according to his psychological tolerance and provided psychological guidance to reduce his fear and avoid the influence of psychological factors on the insulin desensitization results. We explained the entire process of insulin desensitization to the patient and informed him in advance that the medical staff would take emergency measures in case of allergy, to help the patient to reduce psychological stress. During each desensitization process, we comforted the patient, answered his questions, listened to his complaints, assisted in effective communication between the patient and the doctor, and calmed the patient's emotions. Patients who experience unsuccessful desensitization for the first time will have serious anxiety and fear; some will lose confidence, thus resulting in unsuccessful desensitization. Desensitization treatment is a relatively long process, particularly for difficult patients who need to be repeatedly induced to generate an immune response to desensitize successfully. Psychological care is, therefore, a necessary measure.

Assessment of the skin: Prior to desensitization treatment, it is necessary to evaluate the local skin condition of the patient in advance, to observe whether there is bleeding, congestion, discoloration, induration, pain, and subcutaneous lipodystrophy in the skin of the desensitized site. Palpation of the local skin is an important method to evaluate the skin and to identify subcutaneous induration. In this case, the patient's body mass index (BMI) was < 25 kg/m². Parts of the abdomen with relatively more subcutaneous fat were chosen as the site for desensitization. We told the patient to wash the skin in advance to avoid interference with the desensitization process.

Table 1 Results of various insulin test nodules (per:mm)

| Time | Insulin | Humulin N | Insulin aspart | NovolinR | Insulin detemir | Insulin lispro | Novolin N | Insulin glargine | Humulin R |
|--------|---------|-----------|----------------|----------|-----------------|----------------|-----------|------------------|-----------|
| 10 min | 15 × 11 | 26 × 16 | 32 × 15 | 22 × 13 | 15 × 11 | 23 × 12 | 19 × 12 | 27 × 15 | 32 × 15 |
| 15 min | 15 × 12 | 23 × 18 | 32 × 15 | 22 × 13 | 15 × 11 | 20 × 12 | 15 × 12 | 25 × 16 | 31 × 17 |
| 30 min | 21 × 12 | 25 × 15 | 35 × 15 | 30 × 14 | 20 × 12 | 21 × 12 | 20 × 13 | 25 × 14 | 35 × 20 |



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Figure 1 Results of various insulin test nodules.

Configuration of insulin desensitization preparations: We used traditional subcutaneous injections for desensitization. Solution A at a concentration of 0.1 U/mL was prepared with 0.1 mL of Humalog (100 U/mL) and 100 mL of NS. Solution B at a concentration of 0.01 U/mL was prepared with 1 mL of solution A and 9 mL NS. Solution C at a concentration of 1 U/mL was prepared with 0.1 mL of Humalog (100 U/mL) and 10 mL of NS. The starting dose was 0.005 U and the dose was increased every 30 min until the subcutaneous injection of the original solution (Humalog) 3 U (Table 2). At the end of each injection, the injection point was marked. The patient started to experience skin itching, subcutaneous nodules, and a red halo when the insulin dose reached 3 U, thus indicating that routine desensitization was not successful. Desensitization with Novolin R and insulin detemir was performed for 3 d. The desensitization solutions were prepared according to the method described above. After 3 d of continuous insulin desensitization, the subcutaneous nodules and pruritus were significantly reduced, and the process of desensitization was relatively smooth.

First aid materials: A number of first aid materials were maintained close to the patient's bed in a rescue vehicle during treatment, including epinephrine, dopamine, a tracheotomy set, an oxygen inhalation device, an intravenous infusion trocar, a tourniquet, and an ECG monitor.

Key points of nursing during the desensitization test

Nursing care for standard syringe desensitization: From the beginning to the end of the experiment, the specialty nurse was responsible for the entire process. An experienced nurse was responsible for the puncture which could avoid puncture failure caused by the lack of skills. Advanced nursing skills could also reduce a patient's fear of desensitization tests. In this case, we need to carefully consider the angle of puncture when injecting insulin subcutaneously since the patient was thin, so as to avoid the needle being placed in a position that was too deep which could cause the liquid injected into the muscle tissue, or placing the needle too shallow which could cause the insulin stay under the skin. The above situations could cause local swelling or the slow absorption of insulin. Prior to each injection of insulin, we used alcohol to disinfect the skin at the injection site and made sure that the skin was dry before puncture. Next, we drew a circle around each injection point and marked each point with a number according to the doctor's orders. The responsible nurse carefully observed the local skin reaction, listened to any complaints from the patient, and recorded the results at the appropriate time in the desensitization observation table. The nurse should also notify the doctor if the patient experienced any complaints.

Observation of allergic reactions: Allergic reactions were recorded in the desensitization observation table. We observed skin changes at the puncture site according to the schedule and noted whether the patient experienced redness, sclerosis, or itching. During the process of desensitization, a patient may undergo allergic reaction at any time. In this case, the patient and attending nurses needed to be aware of the potential occurrence of systemic allergic reactions, including shock and laryngeal edema, since the

Table 2 Configuration of insulin desensitization preparations

| Time | Solution type | Dosage (mL) | Units (IU) | Adverse reactions |
|-------|------------------|-------------|------------|---|
| 10:30 | B | 0.5 | 0.005 | / |
| 11:00 | A | 0.1 | 0.01 | / |
| 11:30 | A | 0.2 | 0.02 | / |
| 12:00 | A | 0.4 | 0.04 | / |
| 12:30 | A | 0.8 | 0.08 | / |
| 13:00 | C | 0.16 | 0.16 | / |
| 13:30 | C | 0.32 | 0.32 | / |
| 14:00 | C | 0.16 | 0.16 | / |
| 14:30 | C | 0.32 | 0.32 | / |
| 15:00 | C | 0.8 | 0.8 | / |
| 15:30 | C | 0.16 | 0.16 | / |
| 16:00 | C | 0.32 | 0.32 | / |
| 16:30 | C | 0.64 | 0.64 | / |
| 17:00 | C | 1.0 | 1.0 | Mild itching, no wheals |
| 18:00 | Humalog 100 U/mL | 2.0 | / | Mild itching, no wheals |
| 19:00 | Humalog 100 U/mL | 3.0 | / | Patchy lesions on the skin at and beyond the injection site |

A: Solution A at a concentration of 0.1 U/mL prepared with 0.1 mL of Humalog (100 U/mL) and 100 mL of NS; B: Solution B at a concentration of 0.01 U/mL prepared with 1 mL of solution A and 9 mL NS; C: Solution C at a concentration of 1 U/mL was prepared with 0.1 mL of Humalog (100 U/ mL) and 10 mL of NS.

patient's allergic reactions to insulin were serious. During the process of desensitization, the rescue vehicle was placed next to the patient's bed. The patient's reactions to insulin and complaints were recorded after each injection. In case of emergency, we were ready to perform rescue at any time. The possibility of delayed allergic reactions should also be paid attention to.

Being alert to hypoglycemia: Due to the long process of the desensitization, the accumulation of insulin which was injected in the body may lead to hypoglycemia[4]. Therefore, during the process of desensitization, it was necessary to closely monitor blood glucose (once an hour). We also taught the patient to identify hypoglycemia in a timely manner according to their own symptoms. Symptoms of hypoglycemia included dizziness, shaking hands, palpitation, sweating, and so on. If hypoglycemia occurs, the doctor should be informed in a timely manner. If the blood glucose is lower than 3.9 mmol/L, the patient is required to eat.

Care of subcutaneous induration: Due to repeated desensitization, our patient developed subcutaneous induration at the injection site. Therefore, the patient was given appropriate local skin care after each desensitization. It is important to educate patients to use warm water or potato patch to promote the absorption of local induration.

Use of antihistamines drugs: While the patient was being treated with insulin injection, he was also administered with anti-allergy therapy (Ebastine)[5-7]. He did not develop any allergic symptoms. It is important that nurses guide patients to take such therapies on time, and patients need to be instructed to take medicine after discharge.

Key points of nursing after the desensitization test

For this patient, the total insulin dosage before the desensitization test was 52 IU, but the total dosage decreased to 18 IU after the desensitization. Insulin autoantibody (IAA) titer reduction was the possible cause. Due to this reason, diabetes specialist nurse should not rush to add insulin to the original dose after successful insulin desensitization, but should explore a new dose based on blood glucose monitoring instead.

DISCUSSION

Since the launch of recombinant human insulin, the incidence of insulin hypersensitivity has been significantly reduced. The three-dimensional structure of insulin molecules may change greatly, thus leading to immunogenicity, which has been seen in cases of allergy to human insulin. Insulin is irreplaceable for some diabetic patients. The early use of insulin can alleviate the process of islet β cell injury in LADA patients and improve blood glucose control[8].

Based on a variety of insulin preparations and insulin analogues, desensitization is the preferred treatment for patients with insulin hypersensitivity. Patients can easily achieve insulin desensitization successfully if they can overcome the fear of insulin allergy and the fear of painful subcutaneous injections during desensitization[9]. Therefore, it is important that nurses actively help the patient to overcome psychological barriers in patients who need insulin desensitization. Prior to desensitization, it is important to understand the patient's condition, communicate with the patient fully, and provide the patient with sufficient psychological support. Nurses need to use psychological nursing methods to comfort patients, reduce their fear, and change their psychological attitude. During the process of desensitization, it is important to comfort patients, answer their questions, listen to their complaints, help them to communicate with doctors effectively, and appease their negative emotions. It is also important to inform patients in advance that medical staff will take first aid measures to help them reduce their psychological pressure.

Local lipodystrophy caused by insulin injection is a rare adverse reaction to insulin. Although some studies have reported lipodystrophy after insulin allergy[10], the increasing number of different human insulin analogues has led to a significant reduction in the incidence of adverse reactions (0.2%-3.6%) [11]. After the occurrence of such adverse reactions, the most commonly used countermeasures are changing the type of insulin preparation, changing the administration method, and changing the injection site[12]. Attempts to desensitize the patient with an insulin pump failed in an external hospital. In addition, this method is expensive. Furthermore, subcutaneous lipodystrophy occurred at the infusion site and it was not appropriate to change the type of insulin preparation after desensitization. Therefore, changing the injection site has become the first choice to avoid lipodystrophy at the insulin injection site. It is important to evaluate the local skin conditions at the injection site prior to injection, and observe the skin for bleeding, congestion, discoloration, induration, pain, and subcutaneous lipodystrophy. The skin should also be palpated. Palpation of the local skin is an important method to evaluate skin and detect subcutaneous induration. It is also important to tell the patient to wash the skin in advance. This will help to avoid infection. Once the decision is made to administer Humalog, it is important to provide one-to-one individualized education for patients. Nurses should also provide patients with a personal demonstration of the method used to inject insulin. Large and small rotations were chosen. Large rotation refers to the abdomen, the outside of the upper arm, and the outside of the thigh. One site should be selected for rotation each week. Small rotation means that the position of each injection is about 2-3 cm away from the previous position. The patient should avoid repeated injection at a previous injection site[13] and provide time for the skin at the injection site to recover fully to avoid lipodystrophy. The patient should be asked to cooperate and correct their mistakes. The patient also needs to be told the importance of the rotation principle and to wait 10 s before pulling out the needle. Needles should be changed each time and the needle injection site should be pressed gently before injection to avoid injecting into lipodystrophy or subcutaneous fat thinning. After changing the injection site, our patient did not develop new lipodystrophy during the period of hospitalization.

The main manifestations of insulin autoimmune syndrome are recurrent hypoglycemia, a significant increase in immune active insulin levels, and an increase in IAA titer[14]. Hypoglycemia is dangerous in diabetics and may even cause coma or sudden death. When patients develop symptoms of hypoglycemia, it is important to recognize the relevant symptoms as soon as possible. In cases of hypoglycemia, it is important to provide individualized monitoring. The regular monitoring of blood sugar is important. We should also advise patients to identify the symptoms of hypoglycemia, such as panic, shaking hands, sweating, and fatigue. Patients should be asked to have more meals a day but less food at each, and try to choose food with a low glycemic index[15]. Some patients can take α -glucosidase inhibitors to help avoid hypoglycemia[15]. Patients must be taught to deal with hypoglycemia, and how to eat food responsibly to correct this condition, for instance, eating 15 g of carbohydrates and waiting 15 min to monitor blood glucose again to confirm whether the blood glucose rises to the normal range. If it is still very low, the meal should be repeated until blood glucose rises to the normal range[16].

In this paper, we summarize the desensitization of a case of insulin allergy, insulin-related lipodystrophy, and exogenous insulin autoimmune syndrome, from a nurse's point of view. When using conventional syringes for subcutaneous injection desensitization, it is necessary to accurately configure desensitization agents, cultivate excellent hypodermic injection nursing technology, pay attention to the psychological needs of the patients, and master certain psychological nursing skills. The patient in this case also had insulin allergy, insulin-related lipodystrophy, and exogenous insulin autoimmune syndrome. These conditions required higher technical requirements, increased observation ability, and professional knowledge. Therefore, as the main operator in desensitization therapy, nurses play a key role in desensitization therapy.

CONCLUSION

We summarize the nursing experience of a case with complex insulin allergy requiring desensitization treatment. Our approach is very practical and can be applied to similar patients needing insulin desensitization.

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FOOTNOTES

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Country/Territory of origin: China

ORCID number: Fang He 0000-0003-1396-2391; Ling-Ling Xu 0000-0003-1341-4141; Yu-Xiu Li 0000-0001-7500-0855; Ya-Xiu Dong 0000-0002-9551-5597.

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