

Survey of Insulin Pump with Glucagon and Food Intake for Type 1 Diabetes

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Abstract: An objective of this paper is to survey for the insulin pump with glucagon and food intake to control severe hypoglycemia (<40mg/dl) for type1 diabetes. This study helps to give the clear idea about the effectiveness and weakness of glucagon and food intake. The dosage amount of glucagon for every adult and child is > 20kg will receive 1mg, < 20kg will receive 0.5mg and for food intake the diabetes patients will receive 15-20 grams of simple carbohydrates, no diet foods were to use at the time of hypoglycemia. A recovered time of insensible patients usually back to sensible within quick time of <5 minutes of receiving glucagon, but in food intake it will take more than 15 minutes. By use of glucagon the diabetic patients can have a better life compared to food intakes.

Key words: Intake • Glucagon • Insulin pump • Hypoglycemia

INTRODUCTION

In 1920 Kimball and Murlin [1] was studied about pancreas and establish an extra element of hyperglycemia physics. In 1950 Roger Unger [2] is the first person to describe “bi-hormonal” and he distinguished the diabetes by lacking of insulin and excess of glucagon. Glucagon was distinguished as a foremost motivation of liverwort glucose creation. And this glucagon is a hormone which makes to release the glucose from the liver to the blood. Mainly during fasting time this glucagon may play an important role by stimulating glucose production.

This innovation led to exceed intellect of the relationship between insulin and glucagon, as fallows principal to a bi-hormonal description of diabetes. In the year 1976 insulin pump therapy was introduced and it’s often called as continuous subcutaneous insulin infusion [3,4]. This insulin pump therapy helps to maintain the strict glycemc control for every diabetes type 1 patients. In 1987 Islet Amyloid Precursor Polypeptide (IAPP) was discovered autonomously by the two groups as the foremost components of diabetes. Beta cells wrought polypeptide called amyline [5].

Amyline was firm to get a function that harmonizes that of insulin and establish to be lacking of insulin in diabetes patient. Our body needs energy for functions all

over the body especially brain function. After food intake, some of the foods are converted into sugar (glucose) like bread, rice, potatoes are rich in carbohydrates, and in addition we will have sugar foods like fructose, lactose and galactose. In human body the pancreas contains four different types of cells namely alpha cells, beta cells, gamma cells and delta cells [6]. An alpha cell which secretes glucagon, which helps to release the glucose from the liver into bloodstream and it used to raise the sugar level quickly and which contains 29 amino acids. Beta cells which secrete insulin and it help to lower the sugar level. After food intake pancreas will release the hormones (insulin, glucagon) which balance the sugar level based on food intake.

This comparison will give a better understanding and gives quality of life for diabetes patient computers on the back end, thus significantly speeding up the application for the user, which just pays for the used services.

Background of the Study: Most diabetic patients will fall on hypoglycemia very quickly this is due to imbalance of food intake and excess amount of insulin dosage. Always the diabetic patients will concentrate to control the diabetes by providing insulin and food intake. Diabetic patients often will get hyperglycemia or hypoglycemia due to without proper health care.

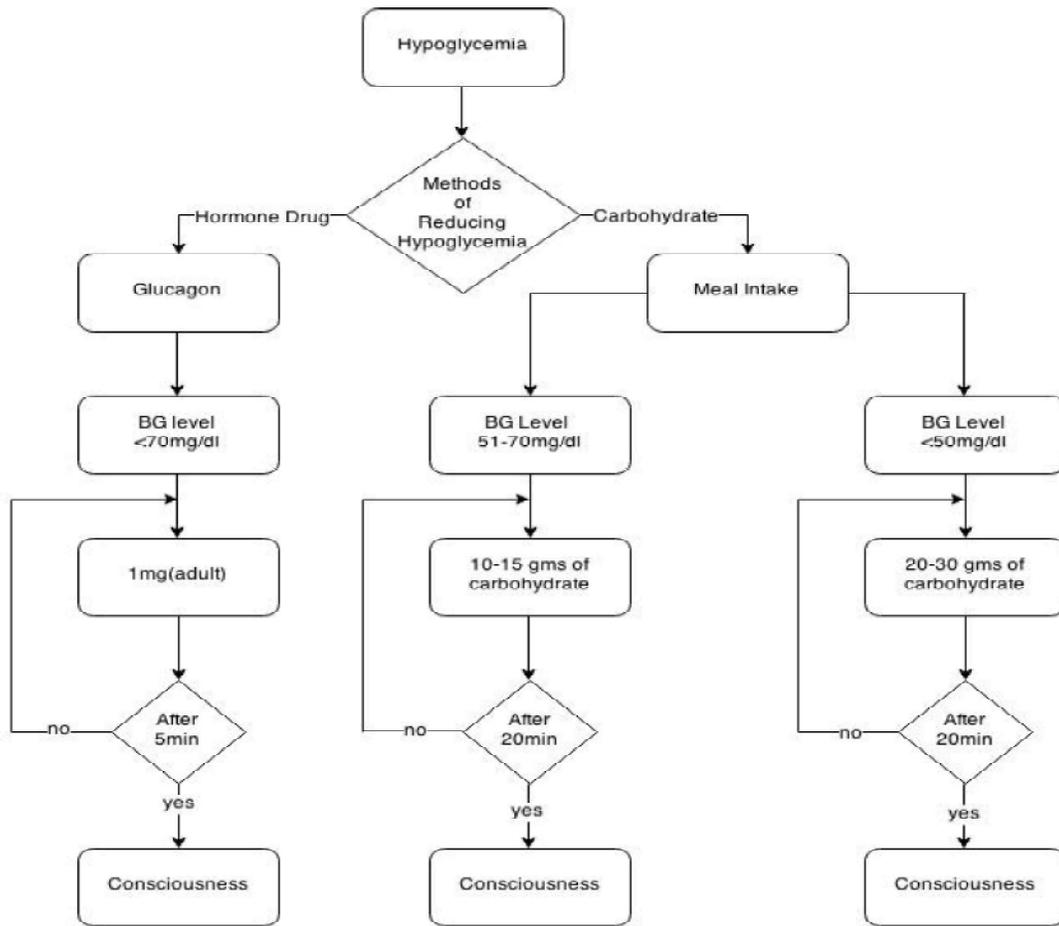


Fig. 1: Preventing of Ipoglycemia

Compare to hyperglycemia and hypoglycemia, the hypoglycemia may have quick reactions like Jerkiness, Tenseness, Sweating, Rigor, clamminess [7] and sometimes severe hypoglycemia (<40 mg/dl) which may cause coma or death. To control hypoglycemia diabetic patients may use a glucagon injection or food intake. Compare to food intake glucagon is a very quick reaction and it helps to raise the blood glucose level immediately. Sometime this glucagon may causes of increasing slow blood clotting. How to overcome this glucagon causes will tell in next paper.

Statement of Problem: This hypoglycemia may occur due to excess injected insulin or oral glipizide [8]. To overcome hypoglycemia has to use either glucagon or food intake. The dosage amount of glucagon for every adult and child, > 20kg will receive 1mg, < 20kg will receive 0.5mg and for food intake the diabetes patients will receive 15-20 grams of simple carbohydrates like 1 tablespoon sugar, 1% milk,

1 tablespoon honey, 2 tablespoons of raisins, gel tube (follow instruction from package), glucose table (follow instruction from package), biscuits etc, no diet foods were to use at the time of hypoglycemia as shown in Fig. 1.

Purpose of Study: The aim of the study is to differentiate the usefulness of an insulin pump with a glucagon injection to improve the hypoglycemia for type1 diabetic patients compared to insulin pump with food intake as shown in Fig. 2. Based on blood glucose level patients with type1 diabetes can use both insulin pump with glucagon and insulin pump with food. At the time of hypoglycemia (70 mg/dl) the type1 diabetic patients can use an insulin pump with food intake and at the time of severe hypoglycemia (40 mg/dl) the type1 diabetic patients can have an insulin pump with glucagon injection. This review which helps to understand what is hypoglycemia, how to identify its symptoms and how to prevent it [9].

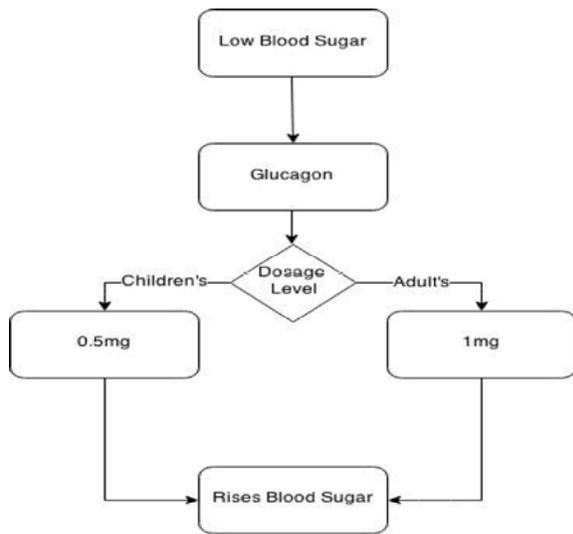


Fig. 2: Rise of Blood Sugar by Use of Insulin Pump with Glucagon

Research Questions:

- RQ1.** How valuable is insulin pump with glucagon therapy in improving hypoglycemic control among patients with type1 diabetes in comparison to food intake?
- RQ2.** What are the effects do other patient characteristics have to hypoglycemic control on the method of insulin pump meal intake?

METHODS

Hypothetical Structure: The hypothetical structure directional this study was about “theory of quality health care” by Donabedian’s. Based on the Donabedian’s framework [10], in this study structure is referred as the insulin pump. Process refers to insulin pump settings, glycemic control (by checking blood glucose level, based on the level they have to release the insulin dose). The insulin dosage can be checked by doctors to make sure the exactness of the insulin pump setting.

In addition, to improve the glycemic control of diabetes patients Doctors have measured the efficiency of insulin pump and they also can review the blood test (HgbA1c), blood glucose level, and pump data. The outcome is referred as blood glucose level of the diabetes patients.

Evolution of Pumps: Last 30 decade many researchers had found out their methods and tools to make the human under glycemic control. Since from 1963-2013 [11] there are lots of pumps have been released into this market but they are not 100% artificial pancreas. So far there is no controlling of hypoglycemia in insulin pumps Evolution of pumps is shown in Table 1.

Methods of Preventing Hypoglycemia: The average limit for blood glucose for every person is 70-120 mg/dl.

Table 1: Evolution of pumps

Year	Name/ Company	Inventions/Methods	Issues
1963	Dr. Arnold Kadish	Backpack portable insulin pump.	Subcutaneously conveying of insulin, gigantic size and weight.
1973	Dean Kamen	Wearable insulin pump	Absence of controlling basal and bolus, not suitable for long term therapy.
1976	Prof. John Pickup (Father of insulin pump)	Portable Pump -159g (CSII), providing both basal therapy and a pre-set bolus dose.	Needles are painful
2008	Dean Kamen [12]	Autosyrin-ge-AS6C	Fail to offer the controls of safe insulin conveyance.
1985	Minimed- 504	Basal Rate and Bolus Rate.	Non-insulin-accommodating tubing, metal needle, unlucky deficiency of feast bolus memory and every day insulin sums.
2010	Minimed-523/723	Tiny remote for discrete boluses, Good statistics.	Less mindfulness about hypoglycemia. Nonappearance of nourishment database.
1996	Dr. Katherine Crothal /Animas Ping	Links with one touch ping BG meter for program-ing bolus.	Battery changes are turning into a crucial, Can't see the cartridge inside the pump, for standard programming obliged extra catch presses, no statics, can't review the history, constrained repository, insulin board is not partitioning bolus consistently.
2010	Disetronic Medical Systems Inc /ACCU-CHEK	Full pump program-ing via linked meter/rem-ote via Bluetooth communication, Bolus can adjust in percentage.	To perform bolus estimation connected meter is required, Minimum basal rate.05u/hr, can't enter BG physically, manual (must enter supply amount), software is expected to change the basal qualities, computation are perplexing, air pockets while filling.

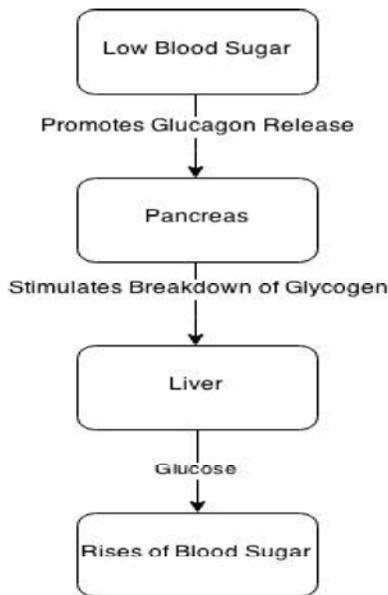


Fig. 3: Rise of Blood Sugar by Use of Insulin Pump with Meal Intake

For every diabetes patient the sugar level will be up and down i.e hyperglycemia and hypoglycemia. To control the sugar level (glycemic control) insulin and glucagon will play an important role for every diabetes patient [13].

Compare to hyperglycemia, hypoglycemia will go down the blood glucose level hazardously low. To prevent the severe hypoglycemia there are two ways are possible (i) meal (ii) glucagon intake (carbohydrate). By meal intake, if the blood sugar level is between 51 to 70mg/dl then have to take 10- 15 grams of carbohydrate supplies.

If blood glucose is less than 50mg/dl means then has to take 20-30 grams of carbohydrate supplies [14,15]. This amount of supply is enough to raise the blood glucose level. After 15 minutes have to check the blood glucose level, if we can't able to find any changes means then have to repeat the same for once again [15]. And by glucagon, it helps to higher the blood glucose level immediately after giving of glucagon hormone. After 5 minutes if the patient is not awake means then need have to repeat for one more time until the patient reaches sensibility [16].

RESULTS

RQ1. How valuable is insulin pump with glucagon therapy in improving hypoglycemic control among patients with type1 diabetes in comparison to food intake?

By an excess of insulin and oral like glucotrol the hypoglycemia will be occurring and by insufficient intake and too much physical action will cause hypoglycemia.

This hypoglycemia can treated in two possible ways like glycogen and meal intake as shown in Fig 3. Compare to meal intake the glycogen recovery time is very quick. Glucagon is reverse perform of insulin and it will raise the blood glucose level. By using bacteria Escherichia coli the artificial glucagon are being manufactured. A glucagon was very useful at the time of severe hypoglycemia because a severe hypoglycemia will cause brain (comma) /death [15, 8]. During the time of severe hypoglycemia a patient will be in unconsciousness, at that time never try to give any food or drink through mouth because it would cause choking. A glucagon will be act as a life span saving treatment and it won't be harmed for children's, adults and aged people.

Dosage Amount for Glucagon:

- For children's, they can use only 0.5mg of glucagon
- For adults, they can use 1mg of glucagon

Dosage Amount for Meal Intake:

- Blood Glucose level(51-70 mg/dl), 10-15gm of carbohydrate
- Blood Glucose level(<50 mg/dl), 20-30gm of carbohydrate

RQ2. What are the effects do other patient characteristics have to hypoglycemic control on the method of insulin pump meal intake?

The meal intake is another method of to controlling hypoglycemia for diabetic patients. Compare to glucagon the meal intake reaction time (15mintues) will be slow and afterwards it may produce hyperglycemia. A patient can have meal intake up to max 50mg/dl of blood glucose.

If the blood glucose falls below 40mg/dl means then the patient will be goes under unconsciousness [8], so at the time oral intake may cause the diabetic patient like chock and the diabetic patients should not take diet foods during the time of hypoglycemia.

CONCLUSION

This survey helps to give the clear concept about the effectiveness and weakness of insulin pump with glucagon and insulin pump with food intake. A glucagon

is a short term aid in dealing hypoglycemia episodes. By using of glucagon the diabetic patient can recover hypoglycemia very quickly compared to food intake and can decrease the number of patients who are admitted to hospital with severe hypoglycemia. Glucagon will be act as a life cycle saving treatment and it won't be damaged for children's, men's, women's and aged people.

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