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Cutaneous Complications of Insulin Therapy In Insulin Dependent Diabetes Mellitus

Dr. Ahmed Sadik Dawood, M. B. CH. B.D.CH.
and
Dr.Mahdi Salman Qadori, M.B.CH.B.D.CH.
Department of Pediatrics, College of Medicine
University of Baghdad, Iraq

Abstract

During the period from the first of March till the first of June 2016, patients with type I Diabetes Mellitus attending the diabetic clinic of Children Welfare Teaching Hospital were assessed for their cutaneous complications of insulin therapy especially at the sites of the injections.
The total number of the sample were 102 patients with male to female ratio of 1:1.3 the mean age for them was 12.2 years ± 5.268 SD.
The cutaneous complication occur in 55.9% of them and the commonest cutaneous complications of insulin therapy in insulin dependent diabetes mellitus was lipohypertrophy of the skin (93%), allergy to insulin occur in (7%) while lipoatrophy and other cutaneous complications were not reported.
The cutaneous complications are associated with increase the incidence of other complications of diabetes mellitus.
Most of these complications occur in the upper arms as they are the usual sites used by the patients for insulin injections and specially in those who either did not change the sites or change it occasionally and also those with wrong technique of injections, all these are either because of poor educations or failure to follow the instructions, as the school achievement of the person who inject the insulin for the patient had no role.
So, proper education about the sites and the technique of insulin injection and the maintenance of this education is the key factor in preventing the development of these complications.

Keywords: Diabetes Mellitus, cutaneous complications, insulin, proper education.

Introduction

Diabetes Mellitus is characterized by hyperglycemia and glycosuria and occurs as a common end point of many disease processes. The most common type occurring in childhood is type I diabetes mellitus (DM1), which is caused by autoimmune destruction of the pancreas. Patients with DM1 have sever and usually permanent insulin deficiency and require insulin for survival and prevention of lifethreating episodes of Ketoacidosis[1].

The incidence and prevalence of all types of diabetes mellitus is increasing at an alarming rate. Modern therapy involves greater and earlier use of intensive insulin regimens in order to achieve better control of

blood glucose levels and reduce the long-term risks associated with the condition. Insulin therapy is associated with important cutaneous adverse effects, which can affect insulin absorption kinetic causing glycemic excursion above and below target levels for blood glucose[(2)].

Aim of the study

To study the cutaneous complications of Insulin therapy in Insulin Dependent Diabetes Mellitus and some factors that may affect their development.

Review of Literatures

Insulin: -

The beta cell of the pancreas (in areas called the islets of langerhans) make the insulin, when the body cannot make enough insulin on it own, a person with diabetes must inject insulin made from other sources, i.e., beef, pork, human insulin (recombinant DNA origin), or human insulin (pork-derived, semisynthetic).

There are areas of outer part of a cell that allow the cell to join or bind with insulin that is in the blood. When the cell and insulin bind together, the cell can take glucose (sugar) from the blood and use it for energy [(3)].

Insulin Regimens: -

There are number of different types of insulin differ in duration of action and time to peak effect. These can be used in various combinations, depending on the needs and goals of the individual patient [(1)].

All preanalog insulin form hexamers, which must dissociate into monomers subcutaneously before being absorbed into the circulation. Thus, a detectable effect of regular insulin is delayed by 30-60 min after injection [(4)].

Lispro (L) and Aspart (A), insulin analogs, are available in which altered amino acid position results in more or less rapid absorption. Lispro is a synthetic human insulin analog in which the amino acids at position 28 and 29 (lysine and proline) are reversed. This alteration in insulin structures result in rapid absorption and onset of action [(1)]. Lispro insulin does not form hexamers (clump of 6 molecules linked together) and thus faster acting than regular which should be injected 30 min or more before meal [(3)].

The most commonly used regimen in school-aged children involves two subcutaneous injections per day of intermediate acting insulin (NPH or lente, with duration about 12-24 hr) and short acting insulin (regular with duration about 6-10 hr), this regimen is preferred because it does not require the patient to give an insulin injection at midday, during school hours.

While Glargine is a new insulin analog in which the amino acid glycine is substituted for asparagine in the A chain of insulin, when insulin Glargine is injected subcutaneously, is precipitates and thus absorbed very slowly [(1)].

Injection Sites of Insulin: -

A person with diabetes injects insulin by putting the needle into the tissue under skin called (subcutaneous).

The places on the body where peoples can inject insulin most easily are:

- The outer area of upper arm.
- Just above and below the waist, except the area right around the navel (a 2-inch circle).
- The upper area of the buttock, just behind the hip bone.
- The front of the thigh, midway to the outer side, 4 inches below the top of the thigh to 4 inches above the knee.

These areas can vary with the size of the person.

Changing the places on the body where a person injects insulin. Changing the injection site prevent lump or small dents from forming in the skin. These lumps or dents are called lipodystrophy. However, people should try to use the same body area for injections that are giving at the same time each day-for example, always using the abdomen for the morning injection or an arm for evening injection.

Using the same body area for this routine injection lessen the possibility of changes in the timing and action of insulin [(3)].

Cutaneous complication of insulin therapy in IDDM: -

(1) Lipoatrophy of skin:-

Common complications of subcutaneous insulin injection include lipoatrophy and lipohypertrophy. Insulin lipoatrophy usually occur approximately 6mo-2yr after initiation of relatively high does of insulin. A dimple or well-circumscribed depression at the site of injection is typically seen, although loss of fat may extend beyond the site of injection, leading to an extensive, depressed plaque. Biopsy reveals a marked decrease or absence of subcutaneous tissue, without inflammation or fibrosis[5]. The development of lipoatrophy may have an immunological basis, predisposed by lipolytic component of certain insulin. Repeated use of the same injection site increase the risk of lipoatrophy-with time, patient learn that these areas are relatively pain free and continue to use them. However, the absorption of insulin from lipoatrophic area is erratic leading to frequent difficulties in achieving ideal blood glucose control. With the increasing use of modified, rapidly absorbed analog insulin (e.g. insulin lispro, insulin aspart) the incidence of lipoatrophy occurring has decreased over recent years. The likelihood of lipoatrophy can be reduced by regular rotation of injection sites but once developed, practical benefit may be obtained by insulin injection into the edge of the area, co-administration of dexamethasone with insulin, or changing the mode of insulin delivery. [2].

Lipoatrophy as a cutaneous complication of insulin therapy has been extremely rare since the introduction of recombinant human insulin [6].

Lispro insulin was not reported to be associated with this complication, but recently, published the first two cases of lipoatrophy associated with lispro insulin in two insulin pump-treated patient [7]. We observed a singular case in which lipoatrophy occurred in two different locations with both buffered human regular insulin and lispro insulin in a patient treated by continuous subcutaneous insulin infusion [8].

(2) Lipohypertrophy of skin: -

Bulging of an area of skin (due to fat accumulation) that for when a person keeps injection insulin into the same spot. Continued injection into these lumpy area delays the absorption of insulin and is not recommended even though injection into lumpy area is painless (as there are no newer endings in the lumps)[3]. Hypertrophy is the most common complication of insulin therapy. Never insulin has also reduced its prevalence considerably, although its adverse effect on diabetic control is similar to lipoatrophy through impaired absorption of insulin into the systemic circulation. Experience with liposuction at these sites is limited although good cosmetic results have been achieved [2].

(3) Insulin Allergy:

This occur when a person's body has an allergic or bad reaction to taking insulin made from pork or beef or from bacteria, or because the insulin is not exactly the same as human insulin or because it has impurities. The allergy can be of two forms sometimes an area of skin becomes red and itchy around the place where the insulin is injected. This is called a local allergy.

In another form, a person's whole body can have a bad reaction this is called a systemic allergy. The person can have hives or red patches all over the body or may feel changes in the heart rate and in the rate of breathing. A doctor may treat this allergy by prescribing purified insulin or by desensitization [3]. Allergic reactions to insulin may be immediate or delayed. The immediate local reaction is probably IgE mediated. It starts as erythema, become urticarial within 30 min and subsides within an hour. The delayed reaction is the most common reaction. It is due to delayed hypersensitivity. About 2 weeks after the initiation of insulin therapy, a pruritic nodule develops with one to two days at the site of injection, lasts for days and heal with hyperpigmentation and scarring, useful adjuncts to managing allergic reactions include addition of dexamethasone to the insulin injection or change in delivery system utilizing insulin pump therapy or potentially inhaled insulin when these become available [2]. A case of human insulin allergy induced by intermediate-acting insulin but not by long acting insulin, developed generalized urticaria after injection of intermediate-acting insulin for diabetes mellitus, so recommendation here to use long acting insulin preparation and was free from symptoms there after [11].

(4) Edema of skin:-

Edema of feet and abdomen is a rare phenomena accompanying initiation of insulin therapy [9]. Which appear shortly after starting or increasing the dose of insulin, it commonly seen in women, and is unrelated

to cardiac or renal disease. The pathogenesis is unclear [12]. It resolves spontaneously, and successful management with ephedrine has also been described. [10]

(5) Other complication of skin:

Localized induration, ulceration and scar formation, cutaneous abscess formation and development of keloid may result from faulty injection techniques. Idiosyncratic reactions are very rare and include pigmentation and occasionally keloid formation. Skin reaction resembling acanthosis nigricans has been reported [12].

Pediatric Diabetes Education:

Unfortunately, most children who meet the hospital's admitting criteria may only have four to five days in the hospital for blood glucose regulation and education [13]. This leaves very little time for the educators to get to know the families and ensure that everyone involved with the child's diabetes control has been properly educated, in addition, some of the patients do not meet the hospital admission criteria, in these instances the insulin regulation and education must be accomplished on an outpatient basis [14].

Diabetes treatment protocol relies heavily on the triad of diet, exercise and insulin, however many patients fail to see the importance of these responsibilities in their day-to-day life and thus run the risk of complication [15].

Common complications of Diabetes Mellitus:

1. Diabetic ketoacidosis: is the end of the metabolic abnormalities resulting from a severe deficiency of insulin or insulin effectiveness. The later occurs during stress as counter regulatory hormones block insulin action. Diabetic ketoacidosis occurs in 20-40% of children with new onset diabetes, and in children with known diabetes who omit insulin doses or who don't successfully manage an inter current illness [4]. Also may be caused by stress and psychological problem and recurrent diabetic ketoacidosis is particular problem in adolescents and may be fatal [16].

2. Hypoglycemia: is the major limitation to tight control of glucose levels. Once injected insulin absorption and action are independent of the glucoselevel, thus creating a unique risk of hypoglycemia from an unbalance insulin effect. Insulin analogs may help reduce but can not eliminate this risk. Most children with type I diabetes can expect mild hypoglycemia each week , moderate hypoglycemia a few times each year , and sever hypoglycemia every few years .These episode are usually not predictable , although exercise , delayed meals or snack , and wide swings in glucose levels increase the risk. [4].

3. Retinopathy: the prevalence of retinopathy in adolescents varies from 18 – 47 % .More than 90 % of the patients with type I diabetes will eventually develop some degree of retinopathy. the earliest sign of diabetic eye disease is the development of the background retinopathy which consist of microaneurysms and haemorrhages with exudates which denote involve the macula .This stage is asymptomatic and dos not damage vision . it may stabilize , regress with improved glycogenic control or progress if poor control continues . Background diabetic retinopathy may , rarely in child hood , progress to proliferative retinopathy. This can be successfully treated in its early stages with laser photocoagulation therapy. All patients with retinopathy should be referred to an ophthalmologist. Cataract may affect patients with diabetes but are vary rare under the age of 20 years[17].

4. Nephropathy: The cumulative incidence of nephropathy after 40 years of diabetes is at least 40% . Nephropathy may lead to chronic renal failure and necessitate dialysis or renal transplantation. Nephropathy is preceded by the development of persistent microalbuminuria which affects approximately 10% of children and adolescents. patient with persistent microalbuminuria should have their blood pressure and their serum urea , electrolytes and creatinie concentration measured and a renal ultrasound performed . Attempts should be made to improve glycaemic control which may the changes .If microalbuminuria persists treatment with angiotensin-converting enzyme (ACE) inhibitors (e.g. Captopril) should be consider, even in the absence of hypertension. This treatment should not be prescribed until the possibility of nondiabetic renal disease has been excluded [18]

5. Neuropathy: The earliest symptoms include numbness and paraesthesia of the feet or hands with evidence of decrease vibration sense , loss of ankle jerk reflexes and diminution in sensation to pinprick on clinical examination . However, clinically

significant neuropathy in adolescence is very rare, although subclinical neuropathy demonstrated by abnormalities of motor nerve conduction velocity have been reported in 20-57% of children with diabetes [17]

6. Growth failure : chronic ill health conditions such as cystic fibrosis , diabetes mellitus , inflammatory bowel disease , chronic renal failure and asthma could be associated with poor growth and weight gain and a delay in the onset of puberty , although with modern treatment regimes and much more careful attention to nutrition , this is rarely seen[19] .

Patients and Methods

This prospective study includes 102 patients with type I diabetes mellitus who were seen and examined at the diabetes clinic of the children welfare teaching hospital over a period of three months from first of March to the first of June 2016

We collect the following information:

1. Name of the.
2. Age.
3. Sex.
4. School achievement of the patient, father, mother and person who injected the insulin for the patients.
5. Date of onset of diabetes.
6. Type of insulin used by patients.
7. Sites of insulin injections and if these are changed occasionally, always, or not changed.
8. The person who injected the insulin to the patient.
9. Education about the usual sites and technique of insulin injection done or not and if it is done by whom?
10. Examination of the patient for presence of any cutaneous complications (Lipohypertrophy, lipoatrophy allergy and others.
11. Check the technique of insulin injection.
12. Any new instructions about the technique and site of the insulin injection given to patient with complications.
13. Did the patient follow the instruction given to him/her or not.
    Any positive family history of IDDM in close relatives.

Results

The total number of patient in our study was 102 patients of whom 44 (43.2%) were males and 58 (56.8%) were females with male to female ratio of 1:1.3, table No.1.

Table 1: Distribution of the patients according to sex.

Sex	Total	%
Male	44	43.2%
Female	58	56.8%
Total	102	100%

The cutaneous complication of insulin therapy, were present 57(55.9%) patients and 45 (44.1%) patients had no complications, table No.2

Table 2: Distribution of patients according to the presence of cutaneous complication of insulin therapy.

Complication	Number of patients	Percentages
Present	57	(55.9%)
Absent	45	(44.1%)
Total	102	(100%)

Seventy-three (71.6%) patients had diabetes for less than 5 years 36 (49.3%) of them had cutaneous complications and 37 (50.7%) had no cutaneous complications.

Twenty (19.6%) patients had diabetes for more than 5 years and less than 10 years, 13 (65%) of them had complications while 7 (35%) had no complications.

Nine (8.8%) patients had diabetes for more than 10 years, 8 (88.9) of them had complications while only 1 (11.1%) had no complications, table No.3.

Table 3: Distribution of patients according to the duration of diabetes mellitus.

Duration of disease in years	Patients with complications No. %	Patients without complications No. %	Total No. %
< 5 years	36 (49.3%)	37 (50.7%)	37 (71.6%)
> 5-10 years	13 (65%)	7 (35%)	20 (19.6%)
> 10 years	8 (88.9%)	1 (11.1%)	9 (8.8%)
Total	57	45	102 (100%)

Out of 57 patients with cutaneous complications of insulin therapy, lipohypertrophy was present in 53 (93%) of patients and allergy in 4 (7%) patient while lipoatrophy and other complications were not reported (0%), table No.4.

Table 4: Distribution of patients according to the types of cutaneous complications.

Type of complications	Number of patients	Percentages
Lipohypertrophy	53	93%
Lipoatrophy	0	0%
Allergy	4	7%
Others	0	0%
Total	57	100%

Among 102 patients, 39 (68.4%) had right and left arm hypertrophy and allergy, 5 (8.8%) had right and left thigh hypertrophy, 3 (5.3%) had right, left arm and thigh hypertrophy, 5 (8.8%) had right arm hypertrophy only, 3 (5.3%) had left arm hypertrophy only and two patients had complications at unusual sites of insulin injection 1 (1.7%) had leg hypertrophy while other one (1.7%) had forearm hypertrophy, table No.5.

Table 5: Distribution of patients with complications according to the different sites of insulin injection.

Sites of insulin injection and complication	Number of patient	Percentage
Right and left arm hypertrophy and allergy	39	68.4%
Right and left thigh hypertrophy	5	8.8%
Right and left arm and thigh hypertrophy	3	5.3%
Right arm hypertrophy	5	8.8%
Left arm hypertrophy	3	5.3%
Unusual sites : leg hypertrophy	1	1.7%
Forearm hypertrophy	1	1.7%
Total	57	100%

Among 102 patients, 15 (14.7%) patient of them had repeated attacks of Diabetic Ketoacidosis, 10 (9.9 %) of them had cutaneous complications and 5 (4.92 %) had no cutaneous complications.

Three (2.9%) patients had hypoglycemia, all of them at cutaneous complications.

Sixteen (15.7%) patients had Retinopathy, 13 (12.7 %) had cutaneous complications and 3 (2.94 %) had no cutaneous complications.

Nine (8.9%) patients had Nephropathy, 7 (6.9 %) had cutaneous complications and 2 (1.96 %) had no cutaneous complications.

Five (4.9%) patients had Neuropathy, 4 (3.9 %) had cutaneous complications and 1 (0.98 %) patients had no cutaneous complications.

Three (2.9%) patients had Growth failure; all of them had cutaneous complications.

- So from 57 (55.9) patients with cutaneous complications, 40(70.2%) patients had other complications of diabetes and 17(29.8%) had no other complication.

- While among 45(44.1%) patients with no cutaneous complications, 11(24.4%) patients had other complications and 34(75.6%) patients had no other complications of diabetes, table no. 6.

Table no. 6: **Distribution of the patients according to the common complication of the Diabetes Mellitus**.

Common complication of D.M.	Patient with complications		Patient without complications		Total	
	No.	%	No.	%	No.	%
Diabetic Ketoacidosis	10	(9.9%)	5	(4.92 %)	15	(14.7%)
Hypoglycemia	3	(2.9%)	0	(0 %)	3	(2.9%)
Retinopathy	13	(12.7%)	3	(2.96 %)	16	(15.7%)
Nephropathy	7	(6.9%)	2	(1.96 %)	9	(8.9%)
Neuropathy	4	(3.9%)	1	(0.98 %)	5	(4.9%)
Growth failure	3	(2.9%)	0	(0 %)	3	(2.9%)
No complications	17	(16.7%)	34	(33.3 %)	51	(50%)
Total	57	(55.9%)	45	(44.1%)	102	(100%)

Eight (7.8%) patients injected insulin in one site all of them had complications 50 (49%) patients change the sites occasionally, 45(90%) of them had complications and 5 (10%) of them had no complications while 44 (43.2%) patients change the sites always, only 4 (9.1%) of them had complications and 40 (90.9%) of them had no complications, table No. 7.

Table 7: - Distribution of patient according to the changing sites of insulin injection.

Changing the site insulin injection	Patients with complications		Patients without complications		Total	
	No.	%	No.	%	No.	%
No changing	8	(100%)	0	(0%)	8	(7.8%)
Occasionally	45	(90%)	5	(10%)	50	(49%)
Always	4	(9.1%)	40	(90.9%)	44	(43.2%)
Total	57		45		102	(100%)

Eight four (84.4%) patients use both Actrapid and montard insulin, 44 (52.4%) of them had complications and 40(41.6%) had no complications, while 18 (17.6%) patient use mixtard, 13 (72.2%) of them had complications and 5 (17.8%) had no complications, table No. 8.

Table 8: Distribution of patients according to the type of insulin used.

Type of insulin	Patients with complications		Patients without complications		**Total**	
	No.	%	No.	%	No.	%
Actrapid+ monotard	44	(52.4%)	40	(41.6%)	84	(82.4%)
Mixtard	13	(72.2%)	5	(27.8%)	18	(17.6%)
Total	57		45		102	(100%)

Ninety-seven (95.1%) patients use right technique for insulin injection, 52 (53.6%) had complication and 4.5 (46.4%) had no complications while 5 (4.9%) of patients use wrong technique all of them (100%) had complications, table No. 9.

Table 9: Distribution of patients according to technique of insulin injection.

Technique of insulin injection	Patients with complications		Patients without complication		Total	
	No.	%	No.	%	No.	%
Right way	52	(53.6%)	45	(46.4%)	97	(95.1%)
Wrong way	5	(100%)	0	(0%)	5	(4.9%)
Total	57		45		102	(100%)

Regarding the school achievement of the person who inject the insulin 12 (11.8%) were illiterate, 28 (72.5%) finish the primary school, 43 (42.1%) finish secondary school and 19 (18.6%) finish the institute or college.

In all these groups there is no much difference between those with complications and those without complications, table No10.

Table 10: Distribution of patients according to the school achievement of the person who inject the insulin.

School achievement of person who injected the insulin.	Patients with complications.		Patients without complications		Total.	
	No.	%	No.	%	No.	%
Illiterate	7	(58.3%)	5	(41.7%)	12	(11.8%)
Primary school	14	(50%)	14	(50%)	28	(27.5%)
Secondary school	26	(60.5%)	17	(39.5%)	43	(42.1%)
The institute or college	10	(52.6%)	9	(47.4%)	19	(18.6%)
Total	57		45		102	(100%)

Seventy (68.6%) patients were following the instructions given during education about the sites and technique of insulin injection, 30 (42.9%) had complication and 40 (57.1%) had no complications while 32 (31.4%) patients were not following the instructions, 27 (84.4%) of them had complications and 5 (15.6%) had no complications, table No.11.

Table 11: Distribution of persons according to the instruction given during education about the insulin injection.

Instructions given during education	Patients with complications		Patients without complications		Total	
	No.	%	No.	%	No.	%
Follow	30	(42.9%)	40	(57.1%)	70	(68.6%)
Not follow	27	(84.4%)	5	(15.6%)	32	(31.4%)
Total	57		45		102	(100%)

Only 14 (13.7%) had positive family history IDDM in close relative with 6 (42.9%) of them had complications and 8 (57.1%) had no complications, table No.12

Table 12: Distribution of patients according to the family history.

Family history of IDDM	Patients with complications		Patients without complications		Total	
	No.	%	No.	%	No.	%
Positive	6	(42.9%)	8	(57.1%)	14	(13.72%)
Negative	51	(57.96%)	37	(42.04%)	88	(86.28%)
Total	57		45		102	(100%)

Discussion

In our study it is apparent that the number of patients with complications is more than those without complications, this finding may be related to either poor education of the families and patients or failure of them to follow the instructions given during education and follow up properly.

Hypertrophy is the most common complications seen in our study and this finding is similar to Richardson T. and Kerr D. Findings, this may be due to poor education or insisting of the patient to reserve the injection in the lumpy area is painless [(3)].

Lipoatrophy was not reported, as it is rare since the introduction of recombinant human insulin [(6)]. And our patients use human insulin.

The incidence of these complications is high during the early years of treatment and increase with time as its development does not require much time and most patients fade up from continuous following of the instructions giving during educations.

Majority of our patients use the upper arm for insulin injection and when hypertrophy occur they continue to inject in the same area of as it become painless as there are no never endings in the lump [(3)].

We reports two cases of insulin injection in unusual sites with complications, leg hypertrophy and fore arm hypertrophy which happened because of wrong information given to the patients about the different sites of insulin injection or they did not follow the correct instructions.

70.2% of patients with cutaneous complications had other complications of diabetes while 75.6 % of those without cutaneous complications had no other complications of diabetes which could be explained on basis of poor education and management in the first group , beside the fact that lipohypertrophy impair the proper absorption from the site of insulin injections [(2)] ,which may affect the control of blood sugar so they develop different types of complications, while those with good education and management had less incidence of complications .

Lipohypertrophy developed in 100% of those who inject the insulin in one area (no changes), in 90% of those who change the site occasionally, and this may be related to poor education or because the site of hypertrophy become painless and other sites relatively painful.

There is no much difference between different types of insulin used in the treatment and the development of complications, except in those who use mixtard and this can be explained that the majority of our patients use combination of actrapid and monotard, and the minority use mixtard because it is not always available for them and they reserve its use for those family with poor education and illiterate, so the complication may be related to this cause also.

All patients with wrong technique of insulin injection develop the complication, due to poor education about this point, although many other patients with right technique had complications, which may be related to other factors.

The school achievement of person who injects the insulin had no role in decreasing the development of complications and it depends mainly on education given in the diabetic ward and clinics by the doctors and medical staff.

It depends also on following of the instructions about the site of injection that were given during the education, so those who did not follow the instructions (84.4%) had the complications.

We thought that presence of positive family history of insulin dependent diabetes mellitus in close relative may have beneficial effect in decreasing the incidence of this type of complications but it seem that it has no effect as some of these patients may contribute to bad education.

Conclusion

1. Lipohypertrophy is the most common complications of insulin therapy in insulin dependent diabetes mellitus than other complications.
2. Cutaneous complications occur during the first few years after initiation of insulin therapy and their incidence increase with time.
3. The most common sites of insulin injection in the body used by the patients and the site of occurrence of cutaneous complications are the upper arms of the patients.
4. cutaneous complications associated with increase the incidence of other complications of diabetes.
5. Important cause of these complications is poor educations about technique and the sites of insulin injection or failure of the patients to follow the instruction given during education as the school achievement of the person who injects the insulin has no role.

Recommendations

(1) Proper education of the family and the patients, and the diabetic instructions about the technique and the sites of insulin injection should be available for the family and the patients.
(2) Rotation of the sites of insulin injection at the usual sites must be done with regularly time.

(3) Examination of the sites of insulin injection should be done in each visit to the diabetic clinic to avoid the development of the complications.
(4) The technique of insulin injection should be checked periodically specially in patients start to had complications or when the person who inject the insulin change.
(5) Any diabetic patient with cutaneous complications should be examined for other more serious complications.

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