Exploring Local Insulin Injection Complication & Patients Knowledge and Practice and Offer Recommendation for Patient

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Abstract

Worldwide diabetes mellitus (DM) prevalence risen in last two decades, estimated to rise to 642 million in 2040. Thousands of patient inject insulin more than once or two times per day. Technique of insulin Injection is vital to correct dose, safety practice. **The Aim:** Exploring local insulin injection complication & patients knowledge and practice and offer recommendation for Patient. **Setting:** Diabetic center at King Kalid Hospital, Njran, (KSA). **Sample:** Random sample of 300 diabetic patients. The study include two tools 1st tool; Interview Questionnaire sheet; which consisted of 4 parts: a): Personal data: to collect personal data of the patients b) Present history: c) Patients’ practices assessment sheet; D) Patients’ assessment sheet it contain of three parts: Part 1; Patients’ knowledge questionnaire sheet: Part 2: Assessment the insulin injection complications; third part: Offer recommendation: The main results, most of the studied patient (62%) ages were more than 50 years old, were Saudi (86%), married (82%). most of diabetic patients (87%) had diabetes for more than five years, (76%) treated with insulin injection for more than five years, 53%, majority of them had un satisfactory knowledge regarding insulin injection complications. The majority of the patients (92%) had lipohypertrophy, more than two third of patients (77%) had pain minor of patients (15%) had bleeding and bruising. **Conclusion:** Most of the studied patient ages were more than 50 years old, Saudi, married, diabetes for more than five years, treated with insulin injection for more than five years, majority of them had un satisfactory knowledge regarding insulin injection complications. The majority of the patients had lipohypertrophy and pain. **Recommendations:** Training program for diabetic patient at the beginning of DM on insulin injection technique, Increase awareness by proper insulin injection technique, and Construct printed hand out (pressure, booklet) to increase patient knowledge regarding insulin injection and care of injected sit.

**Keywords:** Exploring, local insulin injection complication, offer recommendation.

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INTRODUCTION

From a complex illness need to continuous care is Diabetes mellitus (DM). The patients need to education and support self-care these are vital to increase patient knowledge & practices and minimize, preventing or reducing complications through using significant evidence to supports interventions to improve outcomes [1]. DM is one from most important causes of serious complication and even death. It has risen from (4.7%) in 1980 to (8.5%) in 2014 in the Eastern Mediterranean region and highest prevalence 13.7% [2]. In 2015, the estimated number of patient with diabetes worldwide is 415 million and it’s estimated to increase to 642 million in 2040. In the Middle East and North Africa (MENA) region, diabetes is estimated to be 35.4 million. This expected to rise to 11.4% in the MINA region by 2040 [3]. Bahrain is reported by the IDF to be the third in MENA region after Saudi Arabia and Kuwait in the prevalence of Diabetes in 2014.

In 2015, complications of Diabetes are causing a growing burden on the society; family and individual because highly health cost and high morbidity &mortality. from one of the most significant emerging health problems in Middle Eastern countries is DM, prevalence is projected rise to double over the following next two decades in Middle Eastern countries [4].

There is many types of DM presently t, DM no cure it is lifelong condition that needs patients to adhere to a special diet and therapeutic regimen complaint. It is
very important for Patients to follow standardized diabetic care as frequent blood glucose levels monitoring, regular insulin dose, following a designed diet and active exercise and maintaining hygienic care [5].

Pharmacological therapy lifesaving is Insulin for patient. Preparations of insulin are primarily produced by recombinant DNA technology, structurally formulated identical to human insulin or as a human modification of insulin (insulin analogues) to alter pharmacokinetics. Human insulin and insulin analogues are preferred and used by most adults with T2DM [6].

Immediately at diagnosis Patients T2DM will be initiated insulin therapy. Health staff select insulin regimen and educate Patients about it: includes complete information to self management and insulin injection [7].

Incorrect insulin injection technique can lead to not good absorption, decrease blood glucose or hyperglycemia. Other problems include skin as lipohypertrophy or lipoatrophy recommended attention to injection technique [8].

All patients with uncontrolled DM managed only with insulin therapy, commonly problem faced health staff, is the lack of patient awareness regarding injection of insulin; in appropriate injection practices can cause various complications as poor DM control, local pain, oozing blood and bruising, breaking and lodging of injecting needle tip beneath the skin, infection, and in correct dose administration [9].

When dose insulin starting this based on factors as weight, doses ranging from (0.4 to 1.0 units/kg/ day) of total insulin with increase amounts puberty. The American Diabetes Association/JDRF Type 1 Diabetes Sourcebook notes 0.5 units/kg/day as a typical starting dose in patients who are metabolically stable, with higher weight-based dosing required immediately following presentation with ketoacidosis [10].

It should be taught how to match prepare insulin doses to planned carbohydrate intake, premeal blood glucose, and anticipated activity levels to help maintain target blood glucose levels [11].

Categorized Types of insulin based on their time of onset, peak, and duration of action. Rapid-, short-, intermediate-, and long-acting insulin preparations are available for use in the United States. Various pork, beef, and beef-pork combination insulins were previously widely available; however, recombinant human insulin is now used almost exclusively. Commercially prepared insulin mixtures are also available [11].

Regarding to Yaturu [12], delivery systems of insulin currently available include syringes, pumps, jet injectors and pens. The traditional and most predictable method of insulin administration is by subcutaneous injections.

Complications of insulin injection:include both Systematic and Local complications . systemic complications includes; Hypoglycemia, somogyi effect and dawn phenomenon, DKA, HHNS, insulin resistance, and insulin interaction with other medication. Local complications are lipoatrophy and lipohypertrophy, bruising and bleeding, pain, infection, and weight gain [13].

Local complications of include subcutaneous injection, Lipoatrophy and lipohypertrophy,Bruising and Bleeding, Pain, Infection, Allergic reactions, Peripheral Edema:

Management DM in the longterm care (LTC) setting (i.e., nursing homes) is unique. Individualization of health care is important in all patients; however, practical guidance is needed for medical providers as well as the LTC staff and caregivers The American Medical Directors Association guidelines offer a 12-step program for staff patients Teaching proper injection technique is very vital to preserve correct dose, promote safety practice of insulin administration. Should emphasize during injection on sterilization technique previously [14], antiseptic utility swabbing quickly the site of injection [15]. The ADA statement on administration of insulin neither directly advocates nor condemns the use of alcohol swabs, but it recommends that if patient wait until evaporation before injection [16]. Skin Cellulites, inflammation and other injection local complications among patients can occur. Care providers should assess the injecting sites during periodically and advising Patients to rotate sites of injection to avoid the local complications Husain et al., [17]. So that the diabetes care giver plays important role in the initial teaching and periodic review of insulin injection technique for patients. These recommendations help patients to deliver effective and safe injections [1] because Proper technique patient to himself is essential to minimize absorption variability, increase the drug effect, this play a crucial role in the education of patients with diabetes regarding correct insulin injection [18].

The Australian Diabetes Educators Association (ADEA) provide evidence-based practice (EVP) in all items of education and care of diabetic patients. The teaching of injection is a basic role of the diabetes educator. This to ensures correct instruction and education related to injection including the self administration Australian Diabetes Educators Association (ADEA) [19].
Guidelines for preventing LH: include Regular inspection and palpation of insulin sites, not reuse needles, site rotation policy Use larger injection surface areas. Do not inject into LH sites, Reduce dose of insulin in habitual LH site injections when shifting to normal SC tissue, Rule out LH as a cause of poor glycemic control, hypoglycemia, and high glycemic variability, Before starting the injection therapy, the healthcare provider should ensure that patients understand each of these essential topics: The injection regimen, The choice and management of the devices used, The choice, care, and self-examination of the devices used [20].

Significance of the Study
Researchers observe a lot of diabetic patient complain from insulin complications especially local injection complain in which nurse concern and nursing role is very important in this problems also patient file reported that this problem highly cost for patient and community. A Researches concise focus on local insulin complications, to meet patient needs through offer recommendation to minimize it.

AIM OF THE STUDY
Study was conducted to:
1. Exploring local insulin injection complications
2. Exploring patients knowledge and practice
3. Offer recommendation for patient

The research hypothesis
To achieve the aim of this study the following research hypothesis formulated:
1. The local insulin injection complications will happen among diabetic patients.
2. Patients knowledge and practice will poor and insufficient.
3. Patient will need recommendation for insulin injection.

SUBJECTS AND METHODS
Research Design: exploratory descriptive design. to gain more information about the main researchable subject

Setting: The study was conducted in outpatient clinics of diabetic center at King Khalid Hospital, Njran, KSA, which concerned with caring diabetic patients.

Subject: A purposive sample of 300 patients diagnosed with DM.

Inclusion Criteria: All adult diabetic patients whom treated by injecting insulin not suffering from general skin problems.

Exclusion Criteria: Patients under 18 years old, suffering from skin problem, mentally disorder and not able to co operate.

Tools for data collection: Researchers develop tools based on review of relevant literature to collect data after that tested it, and pilot study for tool.

The study include three tools first 1st Tool
Interview Questionnaire sheet: which consisted of 4 parts: a): personal data: developed by the researchers to collect personal characteristics of the patients which include (age, sex, marital status, nationality, qualification, occupation, training programs, ...). b): patient History related insulin dose: It includes questions (onset and duration of insulin injection treatment, doses per day). c) Patients’ practices assessment sheet: developed by researchers, it included a questions related practice composed of. Insulin injection technique, follow up, examination, device used …… Timed allowed to fill this part from 5 to 10 minutes through interviewing with patient. d): Patients’ knowledge questionnaire sheet: It developed by researchers after reviewing literature Munich [21], Moustafa [22], Attia [23], Galal [24] and AADE [25] It contain questions about patients' knowledge about local insulin injection complications, knowledge about proper injection technique and the assessment of injection sit . It was formed of multiple choice questions. Timed allowed to fill this part from 5 to 10 minutes through interviewing with patient.

Scoring system One grade was given for correct answer, and Zero for incorrect answer. The scoring levels were used as the following: Total satisfactory level of knowledge was considered 60% and above. Total unsatisfactory level of knowledge was considered below 60%.

2nd tool: Assessment the insulin injection complications: It developed by the researchers, after reviewing utilizing the relevant literature Hafez [26], Chris [27] and William [28]. It includes local complications (10 items). Timed allowed to fill this part by the researcher from 3 to 5 minutes. Scoring system Each item was answered as follows: 1= occurred. 2= not occurred. Total complications scoring was No complications.

3rd tool: Offer recommendation: It was developed by the researchers based on recent and relevant literature; translated by Arabic language to be easy use for all nationality. Included preventive and curative intervention recommendation for patients to preventing or managing local insulin injection complications.

Tools validity and reliability
Content validity: Content validity was tested through a jury of three experts of medical –surgical nursing, faculty of Nursing, njar University,

Pilot Study
Before performing study, carried out on 10% of the total study subjects. To assess the applicability,
clarity and efficiency of the tools, estimate the time needed for data collection, and test the feasibility of conducting the research. Based on the findings of the pilot study some modifications were done on the tools. The patients included in the pilot study were excluded from the main study group.

D-Field Work

The selection of patients, and collection of data lasted over a period of three months, starting from beginning of July up the end of September. The data was collected three days/week at outpatient clinic at KKH hospital after taking the permission from previous mentioned center and hospital manager to gain their approval and cooperation. The researchers introduces their self to staff and then explains the purpose of the study to gains their cooperation. Researchers start failing questionnaire, -As regarding to interview questionnaire sheet; after that assess patient to detect any local insulin complication, and assess patient knowledge related to practices of insulin injection .at the end present offer of ideal insulin injection technique recommendation to meet patient needs .the researcher met every patient individual in separate room this meeting arranged by all staff helping.

Ethical Considerations

The ethical considerations of this study included the following: The researcher clarified the objective and aim of the study to patients, assured maintaining anonymity and confidentiality of data. Patients was informed that they are allowed to choose to participate or not in the study and they had the right to withdraw from the study at any time, tools were not causing any harm or pain for participant patients, Oral consent was taken to participate in the study.

STATISTICAL DESIGN

Data were verified prior to computerized entry. The Statistical Package for Social Sciences (SPSS version 20.0) was used for that purpose, followed by data analysis and tabulation. Descriptive statistics were applied (e.g., frequency, percentages, mean, and standard deviation). Data were presented using descriptive statistics in the form of frequencies and percentages. Statistical significance was considered at $P \leq 0.05$, highly significance $P < 0.001$ and insignificant was considered at $P > 0.05$.

THE RESULTS

Table 1: Percentage distribution of personal characteristics of the studied patients (n=300)

| Age groups (in years) | Frequency | %  |
|-----------------------|-----------|----|
| 18 - <30              | 33        | 11.0|
| 30- <40               | 33        | 11.0|
| 40-<50                | 48        | 16.0|
| ≥50                   | 186       | 62.0|
| Mean±SD              | 49.75±11.69|
| Gender               |           |    |
| Male                  | 123       | 41.0|
| Female               | 177       | 59.0|
| Nationality           |           |    |
| Others               | 42        | 14.0|
| Saudi                 | 258       | 86.0|
| Marital status        |           |    |
| Single                | 15        | 5.0|
| Married               | 246       | 82.0|
| Divorced              | 9         | 3.0|
| Widowed               | 30        | 10.0|
| Level of education    |           |    |
| Illiterate            | 126       | 42.0|
| Read & write          | 42        | 14.0|
| Secondary education   | 105       | 35.0|
| University education  | 27        | 9.0|
| Occupation            |           |    |
| Not working           | 51        | 17.0|
| Retired               | 27        | 9.0|
| Housewife             | 120       | 40.0|
| Written work          | 54        | 18.0|
| Professional work     | 48        | 16.0|
| Received training programs of insulin injection | | |
| Yes                   | 12        | 4.0|
| No                    | 288       | 96.0|

Table 1 illustrated that more of the studied patient (62%) ages were more than 50 years old, and were female (59%). More than three quarters of the patients were Saudi (86%), and were married (82%). As regard to level of education, it is found that illiteracy was prevailing among (42%), nearly half of the studied patient were not working (49%).

Table 2: Percentage distribution of patient history related insulin dose of the studied patients (n=300)

| Items                           | Frequency | %  |
|---------------------------------|-----------|----|
| Duration of diabetes mellitus   |           |    |
| 1<3Y                            | 18        | 6.0|
| 3<5Y                            | 21        | 7.0|
| >5Y                             | 261       | 87.0|
| Number of insulin injection per day |           |    |
| 1does                           | 51        | 17.0|
| 2does                           | 231       | 77.0|
| 3does                           | 18        | 6.0|
This table showed that, most of diabetic patients (87%) had diabetes for more than five years, (76%) treated with insulin injection for more than five years, more and Start insulin injection more than 5 years, 71% take two dose per day.

Table-3: Frequency and percentage distribution of studied patients according to their practices (n= 300)

| Items                                      | Yes | Sometimes | No |
|--------------------------------------------|-----|-----------|----|
| Flow ideal technique during injection      | 60  | 20.0      | 30 |
| Regularity of insulin injection taken      | 282 | 94.0      | 18 |
| Use pen                                    | 282 | 94.0      | 9  |
| Notify physician of complication           | 258 | 86.0      | 33 |
| Change insulin injection site              | 120 | 40.0      | 159|
| Change insulin injection syringe or pin    | 285 | 95.0      | 8  |
| Examination of injection site every injection | 60  | 20.0      | 156|
| Avoid area of complication when injection  | 141 | 47.0      | 99 |
| Care of area of complication               | 219 | 73.0      | 51 |

Table showed that more about three quarter, (70%) had not follow ideal injection technique Also the majority of them (94%) use pen injection, and notifying physician by complication (86%), more than have change sit and majority change needle, 28%of them examine site, while 73% care of area of complication when injection insulin.

Table-4 and Figure-1 showed that studied patients majority of them had un satisfactory knowledge regarding insulin injection complications.

Table-4: Frequency and percentage distribution of studied sample according to their total knowledge (n=300)

| Total Knowledge | Unsatisfied | Satisfied |
|-----------------|-------------|-----------|
| No              | %           | No        | %           |
| 225             | 75.0        | 75        | 25.0        |

Figure 1: Percentage distribution of studied sample according to their total knowledge

Table-5: Distribution of local insulin injection complications of the studied patients (n=300)

| Local complications of insulin injection | Happened | % | Not happened | % |
|------------------------------------------|----------|---|--------------|---|
| Lipoatrophy                              | 135      | 45.0       | 165          | 55.0 |
| Lipohypertrophy                          | 276      | 92.0       | 24           | 8.0  |
| Bleeding and bruising                    | 45       | 15.0       | 255          | 85.0 |
| Leakage of insulin                       | 57       | 19.0       | 243          | 81.0 |
| Inflammation at site of injection         | 96       | 32.0       | 204          | 68.0 |
| Infection at site of injection            | 12       | 4.0        | 288          | 96.0 |
| Low sensitivity to pain with recurrent injection in same site | 105 | 35.0 | 195 | 65.0 |
| Pain with rotation of site of injection   | 231      | 77.0       | 69           | 23.0 |
| edema                                     | 93       | 31.0       | 207          | 69.0 |
| Local allergic reaction                   | 84       | 28.0       | 216          | 72.0 |
Fig-2: Percentage distribution of local insulin injection complications of the studied patients

Table and Figure showed local insulin injection complications of the study sample. It is clear that, the majority of the patients (92%) had lipohypertrophy, more than two third of patients (77%) had pain minor of patients (15%) had bleeding and bruising.

Table-6: Distribution of the studied patients affected with local insulin injection complications in relation to duration of treatment with insulin and number of insulin injection per day (n=300)

| Duration of treatment with insulin | Number of insulin injection per day | \( X^2 \) | P |
|-----------------------------------|-------------------------------------|----------|---|
| 1<3y | 3<5y | >5y | once | twice | third | More |  \( X^2 \) | P |
| Lipoatrophy | N 20 | 39 | 241 | 1.01 | 0.60 | 58 | 222 | 20 | 0 | 0.47 | 0.78 |
| % 6.5 | 13.0 | 80.4 | |
| Lipohypertrop | N 26 | 42 | 232 | 0.90 | 0.63 | 46 | 234 | 20 | 0 | 0.0 | 2.9 | 0.23 |
| % 8.7 | 14.1 | 77.2 | |
| Bleeding and bruising | N 20 | 20 | 260 | 1.18 | 0.55 | 0 | 279 | 31 | 0 | 0 | 3.6 | 0.16 |
| % 6.7 | 6.7 | 86.7 | |
| Leakage of insulin | N 16 | 32 | 252 | 0.88 | 0.64 | 47 | 221 | 32 | 0 | 0 | 0.85 | 0.65 |
| % 5.3 | 10.5 | 84.2 | |
| Inflammation | N 27 | 36 | 237 | 0.32 | 0.85 | 27 | 155 | 18 | 2.2 | 0.33 |
| % 9.1 | 12.1 | 78.8 | |
| Infection | N 75 | 0 | 225 | 0.32 | 0.85 | 27 | 255 | 18 | 1.2 | 0.53 |
| % 25.0 | 0.0 | 75.0 | |
| Sensitivity | N 75 | 0 | 225 | 0.79 | 0.67 | 71 | 212 | 177 | 0.0 | 15.0 | 0.45 |
| % 25.0 | 0.0 | 75.0 | |
| Pain | N 31 | 47 | 222 | 0.96 | 0.61 | 43 | 242 | 15 | 2.3 | 0.30 |
| % 10.4 | 15.6 | 74.0 | |
| Peripheral edema | N 20 | 48 | 232 | 0.37 | 0.82 | 48 | 242 | 10 | 0.0 | 0.67 | 0.10 |
| % 6.5 | 16.1 | 77.4 | |
| Allergic reaction | N 21 | 30 | 249 | 1.03 | 0.59 | 52 | 207 | 41 | 0.0 | 0.44 | 0.10 |
| % 6.9 | 10.3 | 82.8 | |

Table showed that most of complications happened in patients treated with insulin injection for more than five years, and taken two insulin injections per day, while there is no statistical significance between local insulin injection complications and duration of treatment with insulin or number of insulin injection per day.
This table showed that there is significant statistical relation between patients’ knowledge and pain at level of local insulin injection complications, (P= 0.040)

**DISCUSSION**

Present study discuss the insulin injection complications because wrights injection technique is vital for better control of DM [29]. The multinational surveys (n = 13,289) in 42 countries reported that the injection technique used by patients’ was inappropriate [30]. Studies of some countries, as India and China, reported that a significant gap between the administration of insulin guidelines and injection technique [31]. Incorrect injection techniques of insulin lead to increase consumption of insulin and increase hemoglobin type 1 also are lead to increase frequencies of hypoglycemia and glucose variability. Also faulty injection technique can cause allergy from insulin [32].

**Regarding to Personal data of patients**

The findings of the present study illustrated that more of the studied patient their ages more than 50 years old, this is in accordance with Hafeze et al., [26] who reported that the age of his studied subjects was more than50 years, and Blanco et al., [33] who reported that ages of his studied subjects ranged from 5 to 76 years with a mean ± SD of 49 ± 23 years overall.

As regard to gender, the results of the present study showed that, female patients represent more than half of the study sample; this finding was in agreement with many studies as Abd El-Monem [34] and Hirsch [35] all reported that more than half of their studies patients were female, also Riaz [37], reported that the majority of his studied patients were female.

Regarding nationality, the results of this study revealed that more than three quarters of the study sample were Saudi, this finding in agreement with findings of in relation to marital status, the study findings showed that, more than three quarters of patients were married, this finding is agreement with Galal [38] who mentioned that the majority of their studied patients were married, and this finding might be due to same age groups of the studied sample all of them adult.

Concerning educational level of the studied sample, the result of current study showed that more than one third of them were illiterate. Also this finding not supported by Hafez et al., [33] who reported that about more than three quarter of his studied subjects had illiterate.

In relation to patients’ occupation, the study finding showed that nearly two third of the studied patient were not working these may be related to gender or complications occurred. This finding in accordance with Galal [38] who reported that more than one half of his studied patients were not working.

Regarding receiving training programs, the study finding showed that the majority of the studied patient hadn’t receiving any training programs, and had diabetes and treated with insulin injection for more than five years this finding in agreement with Hafez et al., [26] who reported the same results. Also in agreement with Munib [21] who reported that their studied subjects had disease for duration ranged from one up to ten years.

Regarding number of insulin injection per day the current study revealed that more than three quarters of patients had taken two doses of insulin per day, this finding in agreement with Yarzely et al., [38] who reported that mean number of insulin injection per day of his studied subjects were 5 does.

**Regarding to Patients Practice**

The current study revealed that more about three quarter of subject had not follow ideal injection technique. Also the majority of them use pen injection and notifying physician by complication (86%), more than have change sit and majority change needle, 28% of them examine site, while 73% care of area of complication when injection insulin this may be due to that the diabetic center give patient a lot of concerning and give him adequate supply to insulin injection as...
pen, pen pin, alcohol swap, syringe, needle. Deferent type of Apparatus for glucocheck and needed accessories as strips, or, pins also give other type as libre flash glucose monitor system with needed sensor and special staff educate them about using and checking but neglect items of injection it self. This supported with [39] said that the patients and relatives should educated and reinforced by Healthcare staff about the correct technique and use of insulin pens during first visit and follow-ups. Also [30] who recommended that primed insulin pens prior to administration to varify free and not obstructed [40], added that none of study patients or relatives make this action, on other hand, the majority of them primed it during changing cartridge of insulin and needle. Because Priming is vital to ensure that newly needle is not obstructed and no air bubble also (Mahdy & Mahfouz, 2016)

Also Tendon et al., [41] the needles reuse may lead to infection and loss of lubrication damage tip by breakage or binding also increases the risk of pain, irritation, patient can be avoid lipohypertrophy, Lipohypertrophy through systematic rotation of site [42].

Concerning examine sit 28% of patients not take this action, examined injection site every injection, this finding was supported by FIT 2011 which reported that site of insulin injection should be inspected and palpated by the individual prior to each injection, and area showing signs of lipodystrophy, inflammation, edema or infection should be avoided. This with [40] his study portrayed that majority of subjects did not care or clean the site of injection pre administration as recommended by [30] that should be administer insulin into clean sites using (Ali, Mohamed, & Mahdy, 2018).

This agree with [40] who reported that Around half of the patients in his study hold the needle beneath skin for 5–10 seconds after completely inserting the thumb bottom. Our results were better than those reported in other studies. It is recommended that the injection site should not be massaged after injection. However, a fifth of total patients in our study massaged injection sites after the administration of insulin. His opinion supported by [43] ho recommended that some study patients may need to count past 10,especially when giving higher doses. This is necessary to prevent medication leakage and to get the full dose.

Related patients following up in the outpatient clinic, study revealed that more than two third of studied patients visit diabetic clinic for following up monthly, this finding is in agreement with Moustafa [22] who reported that more than half of his studied subjects were came for following up every three months and more than one third came for following up monthly, this finding in accordance with Abd El-Monem, [34] who reported that majority of his study subjects attended the outpatient clinic regularly but at different times. Also Attia [23] reported that the majority of his study subjects were attending the outpatient clinic for following up.

Regarding the studied patients level of knowledge the current study revealed that majority of studied patients had unsatisfactory level of knowledge, this finding in agreement with Attia [23] who reported that more than half of his studied subjects had average knowledge, and minority revealed good knowledge. Also this finding in agreement with Galal [36] who reported that an extremely significant difference in mean knowledge scores after applying the Education program also (Mahdy & Mahfouz, 2016).

Also this finding in agreement with Moustafa [22] who reported that knowledge of his studied subjects about insulin, its uses, and sites of injection had improved after completion of the program immediate post and after 3 months compared with pre test mean scores. Also this finding in accordance with Abd El-Monem [34] who reported that knowledge of the majority of his studied adolescent and most family knowledge regarding measures to avoid hypoglycemia were incomplete.

Concerning local insulin injection complications the present study revealed that the majority of patients had lipohypertrophy this may be due to the lack of rotation of injection sites, the longer duration of insulin treatment, and this finding is in accordance with several studies reported that hypertrophy was the most common cutaneous complications of insulin therapy Cunningham [44].

Also agreement with Vardar and Kizilci [45] who reported that over time, areas of lipohypertrophy and lipoatrophy, bruising, bleeding can develop as complications for insulin injection.

Most of patients had pain of injection rotated site, this may be due to poor education of correct insulin injection technique, and this finding is similar to Frid et al., [30].

Also one third of the studied patients low sensitivity to injection pain this may be due to coninuous injecting in the same site due to poor education or insistence of the patient to keep injecting insulin into the lumpy area as it is associated with less pain Frid et al., [30] told that Shorter insulin pen needles (4mm) are much safer, less painful, and more efficacious, hence better tolerated and there is lack of evidence for recommending needle longer than 6mm.

Also the findings of the present study revealed that nearly one third of studied patients had inflammation at injection site and edema this may be due to poor education about correct insulin injection technique, this finding in accordance with [46] who
reported that his study patients had many developed cutaneous complications as inflammation.

Relation between variables of the study
A statistical significant difference was observed between patients’ local insulin injection complications including inflammation of injection site, pain of injection rotated site, and allergic reaction in relation to lifestyle items including smoking, this supported by this finding was supported by Leclair [47], who reported that due to possibility of worsening metabolic control during exercise resulting in either hypoglycemia or hyperglycemia, all factors to be considered in order to anticipate the hypoglycemic or hyperglycemic effect of exercise, initial glycaemia, time of the last insulin injection, injection site, diet, time of the day, exercise type.

A statistical significant difference was observed between local insulin injection complications including lipoatrophy in relation to lifestyle items including hygiene habit, this was in agreement with Chakraborty and Bhattacharjee [32], who reported that lipoatrophy of insulin therapy may be limited by regularly inspecting the injection sites and changing the type of insulin and injection site eventually relieves the fat atrophy. Also this finding was supported by Munib [21], who reported that local complications resulting from incorrect injection technique may be common among insulin requiring diabetic patients like localized indurations, ulceration and scar formation, cutaneous abscess formation and development of keloid also (Arafat, Mahdy, & El-Kashif, 2018)mentioned that.

Also FIT, 2011 reported that local bruising and/or bleeding will occasionally occur at the injection site and is seen more frequently in patients taking anti-platelet therapy. This does not appear to be associated with specific needle length or site but may be affected by injection technique. Also, this finding was supported by [25] which reported that waiting until topical alcohol (if used) has evaporated completely before injection reducing pain of injection.

CONCLUSION
Main conclusion of present study
- The majority of the patients (92%) had lipohypertrophy, more than two third of patients (77%) had pain . minor of patients (15%) had bleeding and bruising
- Most of patient (70%) not follow proper technique of injection complication.
- Most of patients (76%) treated with insulin injection for more than five years, 71% take two dose per day.
- The majority of them (75%) had unsatisfactory knowledge regarding insulin injection complications.

According to study Conclusion the following is recommended
- Training program for diabetic patient at the beginning of DM on insulin injection technique.
- Increase awareness by proper insulin injection technique.
- Construct printed hand out (pressure, booklet...) to increase patient knowledge regarding insulin injection and care of injected site.

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