March 2022, Vol. 10, No. 1
ISSN 2163-758X

Insulin Injection Technique in Tlemcen, the Western Region of Algeria

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Abstract

This study presents the second part of the results of the research on the insulin injection technique in patients in the region of Tlemcen, Algeria. The 100 patients included in the study were interviewed using the “patient” questionnaire in the Injection Technique Questionnaire (ITQ) 2016 survey and the results were compared with those of the ITQ 2016 worldwide survey. The more frequent use of injection pen needles longer than 6 mm exposes Algerian patients to the risk of IM injections and glycemic fluctuations. Hypoglycemic and hyperglycemic episodes are more frequent among Algerians whereas DKA is as frequent as around the world. Algerian patients expose themselves and others to injuries from insulin injection devices more than the global population. That happens mainly through improper disposal of the injection equipment and using public waste bins instead of designated containers for medical waste. This second part of the Algerian study on insulin injection technique provides new information and insights into patient practices. The gaps and deficiencies observed should be corrected in the future to improve this aspect of insulin users' care management.

Introduction

According to the International Diabetes Federation's latest figures, the incidence of diabetes in Algeria has increased to 7.2 percent among people aged 20 to 79, or one adult in every 16 people. Algeria is among the top ten countries in the world for both the number of children with type 1 diabetes and the number of new cases of type 1 diabetes ("Atlas du diabète de la FID - Neuvième édition," 2019). As a result, strengthening diabetes control continues to be a national public health priority.

Insulin is the gold standard treatment for type 1 diabetes, which is caused by a complete lack of this hormone in the body. It is also used in the early stages of type 2 diabetes, but mostly as the last resort in this group of patients when the disease has progressed (Sorli & Heile, 2014). Mastering the injection technique allows the patient to deliver the desired dose of insulin in order to achieve the glycemic goal, making it critical in diabetes management. In a previous work, we highlighted certain injection practices of Algerian patients using insulin. “Almost all Algerians prefer pens, injecting preferentially with 6- and 8-mm needles in thighs and arms instead of the abdomen; they do not seem to pay attention to re-suspending cloudy insulins and tend to overuse their pen needles”. This work constitutes the continuation of the previous paper on the “insulin injection technique of Algerian patients from the region of Tlemcen, Algeria”. Bearing that in mind, please refer to the previous part for more details on the germination of this work, its methodology and the results, as well as on the characteristics of the 100 surveyed patients (Boukli Hacene et al., 2020) .

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Results

Skipping injections

Skipping an insulin injection is more common (77%) in the Algerian population compared to worldwide statistics, where most patients (55.6%) concede that they do so very rarely (several times a year), the highest percentage of our patients (44.2%) tend to skip their injection more frequently (several times per month). Like in published studies, forgetting is the main reason why most patients never reach their glycemic goal (Table 1)

Table 1: Skipping injections for Algerian and other ITQ2016 patients

Skipping injections		Algeria		Worldwide	
		%	N	%	N
Skipping injections	Yes	77	77	45	5870
	No	23	23	55	7274
Frequency	Often (several times a week)	15.6	12	9	419
	Sometimes (several times a month)	44.2	34	36	1759
	Almost never (several times a year)	40.3	31	56	2724
Reason	I forgot	33.54	54	52	3127
	I didn't eat	18.63	30	9	536
	I was sick (e.g. nausea and vomiting)	8.70	14	N/A	N/A
	I just didn't want to inject	13.66	22	N/A	N/A
	My glucose was too low	25	41	7	439

Hypoglycemia, Diabetic Ketoacidosis (DKA) and Hyperglycemia

The frequency of hypoglycemic and hyperglycemic episodes is higher among our patients (76% and 86%) compared to worldwide patients (57% and 47%), whereas DKA numbers are almost close between the two compared groups (77% vs 83%). Detailed information related to hypoglycemic, DKA and hyperglycemic episodes of Algerian patients are summarized in Tables 2, 3 and 4 respectively.

Table 2: Hypoglycemia for Algerian and ITQ2016 patients

Hypoglycemia		Algeria		Worldwide	
		%	N	%	N
During the last 6 months	Yes	76	76	57	5605
	No	24	24	43	4170
Frequency of needing 3rd party assistance	None	9.2	7	57	3563
	1-2 times	32.9	25	24	1502
	3-5 times	21.1	16	9	587
	More than 5 times	36.8	28	9	559
Needed hospitalization	Yes	18	18	8	594
	No	82	82	92	6563
Number of finger-pricks to check blood glucose	> 4 times a day	11	11		
	3-4 times a day	35	35		

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	1-2 times a day	31	31		
	Several times a week	13	13		
	Rarely or never check	10	10		

Tables 3: Diabetic ketoacidosis for Algerian and ITQ2016 patients

DKA		Algeria		Worldwide	
		%	N	%	N
Hospitalization	Yes	23	23	17	1680
	No	77	77	83	7949
Timing	I've had DKA but only when I was first diagnosed with diabetes	47.8	11	49	867
	I've had DKA but not within the last six months	17.4	4	37	643
	I've had DKA within the last six months	34.8	8	14	248

Table 4: Hyperglycemia for Algerian and ITQ2016 patients

Hyperglycemia		Algeria		Worldwide	
		%	N	%	N
Occurrence	Yes	86	86	47	4531
	No	14	14	53	5079
Frequency	More than 5 high readings/week	26.7	23	24	1179
	3 to 5 high readings/week	32.6	28	26	1306
	1 or 2 high readings/week	25.6	22	26	1279
	An occasional high reading (less than 4 times/month)	15.1	13	24	1198

Needle Stick Injury (NSI)

About half (48%) of Algerians admit that a family member could accidentally get stuck by their needles, most often children (63.8%) because sharp material hangs within hands' range for 56.9% of the surveyed patients (Table 5). Also, the great majority of Algerian patients (80%) recap needles, which constitute a risk for accidental pricking, and put injection material into the trash (90%).

Table 5: Needle Stick Injury for Algerian and ITQ2016 patients

Needle Stick Injury		Algeria		Worldwide	
		%	N	%	N
NSI Risk	Yes	48	48	15	1423
	No	52	52	85	8276
NSI Persons	Children	63.8	37	23	368
	Other family members (e.g. spouse)	32.8	19	39	622
	House keeper or rubbish collector	3.4	2	8	129
	Nurse or other professional	0	0	5	73
	Yes	72.9	13	9	410

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NSI Occurred	No	27.1	35	91	4379
Reason	I don't use devices that prevent injuries to others (safety devices)	26.2	17	23	489
	I don't have appropriate disposal containers for my used sharps	16.9	11	36	760
	Used sharps are sometimes left in places where others might get stuck	56.9	37	19	409
	I'm positive for hepatitis or another blood-borne illness	0	0	4	79

Disposal of injection material

Disposing of injection equipment dangerous for health and the environment in specific containers is a habit that has not yet entered Algerian consumers' lifestyles, since the overwhelming majority gets rid of it in the trash compared to just over the half worldwide (Table 6).

Table 6: Disposal of injection material for Algerian and ITQ2016 patients

		Algeria		Worldwide	
		%	N	%	N
Disposal of used pen needles /syringes	Into a container specially made for used sharps	2	2	21	2650
	Into a home container such as an empty bottle	8	8	23	2943
	Into the rubbish with the cap on	80	80	48	6150
	Into the rubbish without recapping	7	7	7	882
	I clip the needle and it stays in the clipper	3	3	1	160
What is done with the container?	Put it into the rubbish	90	9	40	2489
	Take it to a pharmacist	0	0	13	791
	Take it to a doctor's office	0	0	6	389
	Take it to a laboratory	0	0	0	25
	Take it to the hospital or a clinic	0	0	22	1367
	Take it to a local deposit or collection service	0	0	11	682
	None of the above	10	1	7	440

TTD and HbA1c as a Function of LH

The total daily dose (TTD) of insulin and glycosated hemoglobin (HbA1c) values in patients affected with LH versus those not suffering from LH and injecting into the LH bump area versus those avoiding this bad practice are not statistically significant (Table 7).

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Table 7: TDD of insulin and HbA1c as a Function of LH for Algerian and ITQ2016 patients

Population characteristics	TDD Algeria (UI)		TDD Worldwide (UI)		HbA1C Algeria (%)		HbA1c Worldwide (%)	
	Mean± SD	N	Mean ± SD	N	Mean± SD	N	Mean± SD	N
Presence of LH								
Yes	56.75 ± 35.17	44	55.2 ± 33.0	2192	8.68 ± 2.68	44	8.85 ± 2.7	2205
No	53.61 ± 31.32	56	45.1 ± 31.5	4889	8.28 ± 1.55	56	8.30 ± 1.9	4795
Total	54.99 ± 32.94	100	39.9 ± 17.2	7081	8.46 ± 1.96	100	8.47 ± 2.2	7000
Injecting into LH								
Yes	56.45 ± 35.08	8	56.1 ±33.2	1644	8.88±1.32	8	NI	
No	53.38 ± 16.85	36	47.1 ± 32.2	2064	8.71±2.48	36	NI	
Total	45.23 ± 21.17	44	51.1 ± 32.9	3708	8.75 ± 2.31	44	NI	

HbA1c: Glycosated Hemoglobin, NI: Uninformed, TDD: Total daily dose of insulin

Risk of IM injection

Hirsch and collaborators estimated intramuscular injection risk depending on needle length and injection site (Hirsch, Byron, & Gibney, 2014). Whether injecting into the abdomen, thighs or arms, Algerian patients have a 25% greater risk of getting stuck deeper than in the subcutaneous tissue area and of touching the muscle when using pen needles longer than 6-mm. (Frid, Hirsch, Menchior, Morel, & Strauss, 2016). The Table 8 adapted from Hirsch et al. (2014) was generated assuming that injections were performed straight at 90° angle without pinch-up and that a patient may use more than one site to inject insulin.

Table 8: Estimated IM injection risk by body site for Algerian and ITQ2016 patients

	Abdomen N %	Thigh N %	Buttocks N %	Arm N %
12.7 mm	0	0	0	0
12 mm	1 1.56%	1 1.19%	0	1 1.23%
10 mm	1 1.56%	2 2.38%	0	2 2.46%
8 mm	15 23.43%	21 25%	0	24 29.62%

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6 mm	23 35.93%	29 34.52%	1 100%	28 34.56%
5 mm	14 21.87%	19 22.61%	0	15 18.51%
4.5 mm	1 1.56%	2 2.38%	0	2 2.46%
4 mm	7 10.93%	8 9.52%	0	9 11.11%

Discussion

The risk and the occurrence of needle stick injury are more frequent in the Algerian study population compared with the population worldwide. Our findings incriminate negligence and nonchalance of the patients, who tend to leave their injection tools within the reach of others, especially children. Algerian patients disposing of their injection material in special containers may be considered as marginal, and those taking this effort have no other choice, forced as they are by the lack of services or health care related waste collecting services, but to dispose of the containers into the public rubbish.

The fight against insulin therapy waste is not optimal in many parts of the world (Hassan, Shalaby, Atalla, & Younis, 2021; Montoya, Thompson, Boyle, Leighton, & Cook, 2021; Moray, Manjunath, & Shalini, 2020). Our country should not be left behind, which is why Algerian health authorities must make greater efforts in this field. Firstly, a better education should be carried out to alert and alarm DM patients on insulin of the danger of sharp contaminated products being vehicles for a number of blood-borne diseases. This is critical as the poor knowledge of insulin users on this particular point has been highlighted in many studies (Frid et al., 2016; Hasan et al., 2019a; Moray et al., 2020). Secondly, education alone cannot yield significant results and an effort must be made to ensure the availability of home containers and their collection at the level of local health institutions. Positive results were obtained when this approach was adopted in some countries, for example in Malaysia (Hasan et al., 2019b).

Hospitalizations of Algerian patients due to DKA are almost as common as around the world. Even though mostly described in the pediatric population, more than 80% of patients experiencing this life-threatening preventable condition due to diabetes are adults (Kitabchi, Umpierrez, Miles, & Fisher, 2009). Thus, DKA is experienced by around one third of the cumulative T2DM patients (Nyenwe & Kitabchi, 2016). A recent publication suggests that in this last category of patient, the main precipitating factor of DKA is skipping or missing an insulin injection (Flores et al., 2020). This fits perfectly with our results (77% of the Algerian patients miss their insulin dose). Therefore, we suggest that insulin adherence should be reviewed at every medical visit, even a routine one.

Studies suggest that the presence of lipohypertrophy and injecting into LH bumps are associated with an increased TDD of insulin and higher levels of HbA1c (Kumar et al., 2021; Wang, Huang, Chen, & Tu, 2021), which is not demonstrated in this study probably due to the sample size. Focused detailed information on proper rotation sites, on the use of the recommended short 4-mm pen needle, on a single use of pen needles to reduce the occurrence of LH area and on avoiding injections into LH should be

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received by all patients starting on insulin and those expressing the need for training by a professional (Bochanen et al., 2021; Chen et al., 2021)

Insulin leakage, more common in Type 1 DM than in Type 2 DM and in patients who have or inject in LH bumps, thought to be caused by an insulin needle kept under skin for too short a time and by using longer needles, was reported by more than half of Algerians.

Algerian health professionals might need to pay greater attention to the inspection of insulin injection sites. This would certainly help to detect problems earlier and more effectively as well as to correct some attitudes and complications, such as LHs, LH injections, inadequate rotations, insulin leaks and bleeding. This may lead to a lower injecting apprehension and a better quality of life.

Conclusion

Improvement of the insulin injection technique of Algerian patients will require effective involvement of the entire care chain: patient, health professional and health authorities: the first one by getting more involved, the second one by providing a more detailed and comprehensive injection education, and the last one by providing the first two with the necessary support and resources to catch up with the rest of the world in this matter.

Acknowledgments

Our sincere appreciation is extended to the staff and patients of the internal medicine department of Tlemcen's University Hospital.

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