How should insulin injection be performed?

27 November 2021



How should insulin injection be performed?

Way of insertion: with/ without skin pinch up, insertion angle*	1. Patient advice should be given on lifting skin fold and the angle of injection.[11,21,28,73]	IIA
	2. Adults should use 4-6 mm needles and inject vertically.[28,36,38,48,72]	IIB
	3. When using a needle of ≥ 8mm, patients should lift a skin fold using the thumb and index or middle finger that lifts subcutaneous tissue away from the muscle layer.[11,28,32,46,56,62,66,71,73,83]	IIA
	4. Children and slender patients should use 4 or 5 mm needles and may require a skin fold lift.[11,12,37,38]	IIB

** In addition to the recommendation clinical decision should also be based on individual assessment*

How should insulin injection be performed?

Way of insertion: with/ without skin pinch up, insertion angle*	1. Patient advice should be given on lifting skin fold and the angle of injection.	IIA
	2. Adults should use 4-5 mm needles and inject vertically.	IIB
	3. When using a needle of ≥ 6 mm, patients should inject at 45-degree angle and/ or lifting a skin fold using the thumb and index or middle finger that lifts subcutaneous tissue away from the muscle layer.	IIA
	4. Children and slender patients should use 4 mm needles and may require a skin fold lift.	IIB

** In addition to the recommendation clinical decision should also be based on individual assessment*

Adults should use 4-5 mm needles and inject vertically

Bibliographic Citation	Design	Sample size & characteristics	Intervention	Findings	Limitations	Evidence level and quality
#39 Hirsch L et al, 2014	Post hoc analysis	n=388 US adults with widely varying BMI and age >18 with diabetes for ≥1 year	Standardized ultrasound measurement at ST and SCT at injection site	• Across all injection sites, the 4mm length needle has estimated IM risks of <1% in all women and <5% in all males	• 42% of subjects studied had a BMI of >30kg/m^2, and few subjects were thin • Children and adolescents who were not evaluated • IM injection risk estimates are based on anatomic study, needle insertions were not performed.	II
#82 Wang W, Guo X, Shen G, et al., 2016	Multivariate analysis	n=508 Chinese patients, ages 18-85 years with T1 or T2DM	3 independent investigators measured the ST, SCTT and skin-to-myofascial thickness by US.	• 4-mm needle, inserted ⊥ will deposit insulin into the SCT in 99% of Chinese patients	• Involved only patients from a single hospital (Beijing) • Only adults were evaluated • IM % were estimated instead of having actual needle insertions	II

#28

Frid AH, et al. New insulin delivery recommendations. Mayo Clin Proc. 2016; 91(9):1231-1255

Recommendations:

- The 4-mm needle should be inserted perpendicular to the skin (at 90° to the skin surface), not at an angle, regardless of whether a skinfold is raised. A1

Finding 1

Mean Subcutaneous fat thickness

TABLE 1. DEMOGRAPHICS OF THE STUDY POPULATION

Characteristic	*Total*	*Current analysis*
Number	388	341
Gender female	174 (44.8%)	155 (45.5%)
Race		
White/Caucasian	156 (40.2%)	139 (40.8%)
Asian	98 (25.3%)	78 (22.9%)
Black/African American	62 (16.0%)	56 (16.4%)
Hispanic/Latino	55 (14.2%)	52 (15.2%)
Other/two or more races	17 (4.4%)	16 (4.7%)
Diabetes type 2	280 (72.2%)	244 (71.6%)
Age (years)		
Mean (SD)	55.2 (13.4)	55.5 (13.4)
Minimum/maximum	18/85.6	18/85.6
Age category (years)		
18–39	59 (15.2%)	50 (14.7%)
40–59	175 (45.1%)	153 (44.9%)
≥60	154 (39.7%)	138 (40.5%)
Diabetes and insulin use (% of all subjects)		
Type 1	108 (27.8%)	97 (28.4%)
Type 2, no insulin	174 (44.8%)	159 (46.6%)
Type 2, insulin	106 (27.3%)	85 (24.9%)
BMI (kg/m^2)		
Mean (SD)	29.9 (7.1)	29.7 (7.0)
Minimum/maximum	19/65	19/62
BMI category (kg/m^2)		
<25	114 (29.4%)	106 (31.1%)
25–29.9	110 (28.4%)	94 (27.6%)
≥30	164 (42.3%)	141 (41.3%)

Demographics shown for the original study subjects (n=388) and the subset (n=341) with at least one paired measurement of skin and subcutaneous adipose thickness at an injection site.
BMI, body mass index.

Hirsch L et al, 2014

Table 1
Demographics of the study population (n = 503) by diabetes type/insulin use.

Characteristics	Type 1	Type 2/no insulin	Type 2/insulin
Subjects (n)	26	220	257
Gender, male	9 (34.6)	68 (31.3)[a]	117 (45.7)[b]
Age (years)			
Mean (SD)	44.7 (16.3)	57.3 (12.0)	63.9 (9.6)
Min/max	18/73	26/81	35/84
Age groups (years)			
18–39	10 (40.0)	20 (9.1)	4 (1.6)
40–59	8 (32)	100 (45.5)	80 (31.5)
60–85	7 (28)	100 (45.5)	170 (66.9)
Missing values (n)	1	0	3
BMI (kg/m^2)			
Mean (SD)	21.9 (3.0)	24.3 (3.1)	25.2 (3.1)
Min/max	17.2/30.1	17.6/32.7	18.3/34.9
BMI category			
BMI < 24	20 (76.9)	97 (44.1)	95 (37.0)
BMI ≥ 24 but < 28	5 (19.2)	99 (45.0)	114 (44.4)
BMI ≥ 28	1 (3.8)	24 (10.9)	48 (18.7)

Data are presented as n (%) unless otherwise stated.
BMI: body mass index
[a] Missing values for three patients.
[b] Missing values for one patient.

Wang W, Guo X, Shen G, et al., 2016

Finding 1

Mean Subcutaneous fat thickness

Mean SCT:
Arm 10.8mm
Thigh 10.4 mm
Abdomen 13.9 mm
Buttocks 15.4 mm

Females had 5.1 mm greater SCT

Hirsch L et al, 2014

Mean SCT:
Arm 7.23mm
Thigh 7.37 mm
Abdomen 12.14 mm
Buttocks 10.48 mm

Females had 2-3 mm greater SCT

Wang W, Guo X, Shen G, et al., 2016

Finding 2

Injection angle

Needle length, injection angle	*Thigh (n = 338)*	*Arm (n = 311)*	*Abdomen (n = 309)*	*Buttock (n = 250)*
4 mm				
90°	1.6%	1.0%	0.3%	0.1%
45°	NA	NA	NA	NA
5 mm				
90°	4.7%	3.1%	1.1%	0.5%
45°	NA	NA	NA	NA
6 mm				
90°	10.0%	7.0%	2.8%	1.3%
45°	2.2%	1.3%	0.4%	0.2%
8 mm				
90°	25%	19.5%	9.7%	5.5%
45°	8.0%	5.5%	2.1%	1.0%
12.7 mm				
90°	63%	55%	38%	26.9%
45°	34%	27%	14.6%	8.8%

The probability of effective needle length exceeding the distance from the skin surface to muscle fascia is modeled, assuming insertions at 90° or at 45° angles, without lifting a skinfold or compressing skin. The effective needle length was calculated as cosine(90° – injection angle) × (needle length). For example, the effective length of the 8 mm needle inserted at 90° is cosine(0°) × 8 mm, or 8 mm; the effective length of the 8 mm needle inserted at 45° is cosine(45°) × 8 mm, or 5.7 mm.

NA, not applicable. The recommended injection technique with 4 and 5 mm-length needles is 90° insertion without a skinfold nearly all patients, other than very thin ones or young children, in whom a skinfold may be applied. Additionally, a 4 mm needle cannot be inserted at 45° because of physical characteristics of the needle length and hub.

Estimated intramuscular injection risks by body site, needle length and injection angle

Hirsch L et al, 2014

Table 3
Calculated depth of injected insulin delivery according to needle length and angle of insertion.

Needle length, angle	Arm ($n = 508$)			Thigh ($n = 508$)			Abdomen ($n = 508$)			Buttock ($n = 508$)			Average SC (%)	Average IM (%)
	ID (%)	SCT (%)	IM (%)	ID (%)	SCT (%)	IM (%)	ID (%)	SCT (%)	IM (%)	ID (%)	SCT (%)	IM (%)		
4-mm, 90°	0	98.6	1.4	0	99.2	0.8	0	100	0	2.2	97.6	0	98.9	0.6
5-mm, 90°	0	91.7	8.3	0	95.3	4.7	0	100	0	0	100	0	96.8	3.3
6-mm, 90°	0	81.5	18.5	0	87.6	12.4	0	99.4	0.6	0	99.4	0.6	92.0	8.0
8-mm, 90°	0	54.1	45.9	0	59.5	40.5	0	93.7	6.3	0	92.5	7.5	75.0	25.1
8-mm, 45°	0	84.6	15.4	0	90.2	9.8	0	99.6	0.4	0	99.6	0.4	93.5	6.5

ID: intradermal; SCT: subcutaneous tissue; IM: intramuscular.

Wang W, Guo X, Shen G, et al., 2016

When using a needle of ≥6mm, patients should inject at 45-degree angle and/ or lifting a skinfold using the thumb and index or middle finger that lifts subcutaneous tissue away from the muscle layer

Bibliographic Citation	Design	Sample size & characteristics	Intervention	Findings	Limitations	Evidence level and quality
#39 Hirsch L et al, 2014	Post hoc analysis	n=388 US adults with widely varying BMI and age >18 with diabetes for ≥1 year	Standardized ultrasound measurement at ST and SCT at injection site	• Most patients using needles ≥ 6mm in length must either inject at an angle and/or raise a skinfold (“pinch-up”) to effectively reduce IM risk • 8–12.7mm needles are longer than is necessary for consistent SC drug delivery and offer no inherent advantage	• 42% of subjects studied had a BMI of >30kg/m, and few subjects were thin • Children and adolescents who were not evaluated • IM injection risk estimates are based on anatomic study, needle insertions were not performed.	II
#82 Wang W, Guo X, Shen G, et al., 2016	Cross-sectional study	n=508 Chinese patients, ages 18-85 years with T1 or T2DM	3 independent investigators measured the ST, SCTT and skin-to-myofascial thickness by US.	• 75% SCT delivery with 8-mm needles (⊥ insertion angle) • IM risk in the arm and thigh were significantly greater than in the abdomen and buttock	• Involved only patients from a single hospital (Beijing) • Only adults were evaluated • IM % were estimated instead of having actual needle insertions	II

Cont’d

When using a needle of ≥6mm, patients should inject at 45-degree angle and/ or lifting a skinfold using the thumb and index or middle finger that lifts subcutaneous tissue away from the muscle layer

Bibliographic Citation	Design	Sample size & characteristics	Intervention	Findings	Limitations	Evidence level and quality
#42 Hofman PL et al, 2007	Cross over, prospective controlled trials	n=72 Diabetic children (age 6.3-14.3 years, body mass index standard deviation score 1.0±1.4)	Study 1, 200µl air was injected into the abdomen and anterior thigh by an experienced diabetes nurse educator using pinched skin-fold technique, either a ⊥ insertion of 31G 6-mm or ∠ insertion of 30G 8-mm needles. Study 2, injected into abdomen and anterior by via ∠ 6-mm needles with either an unpinched or pinched technique - USG scan	• Pinching increased the subcutaneous fat thickness more in the abdomen than the thigh ($P < 0.001$). In the thigh, pinching increased the subcutaneous fat thickness by 22 ± 6%. • Pinching of the thigh with a subcutaneous fat thickness < 10 mm resulted in no increase in fat depth and indeed reduced fat depth in some subjects (the pinch technique may also pinch muscle and compress the subcutaneous fat). • when inserting a syringe or pen at 90 degrees, it is easier to push on the skin and insert it further, resulting in the observed increased number of intramuscular injections using the 6-mm needles in study • A 45-degree angled 6-mm needle insertion penetrates approximately 4.2 mm	• Small sample size, 37 children participated in study 2 • Involved only single diabetes clinic • Only 2 injection sites	II

Finding 1

Specific injection technique including **site selection** and **angling of the injection** and/ or **raising a skin fold** are required for many patients

- Most patients using needles ≥ 6mm in length must either inject at an angle and/or raise a skinfold (‘‘pinch-up’’) to effectively reduce IM risk (Hirsch et al, 2014)
- Changing the insertion angle of 8-mm needles from 90° to 45° increased the rate of SCT injections and decreased IM rates (Wang W et al, 2016)

Finding 2

45° vs pinch up

- **Pinching up the skin** is one method that has been documented by CT scan and ultrasonography to increases the chance of subcutaneous injection

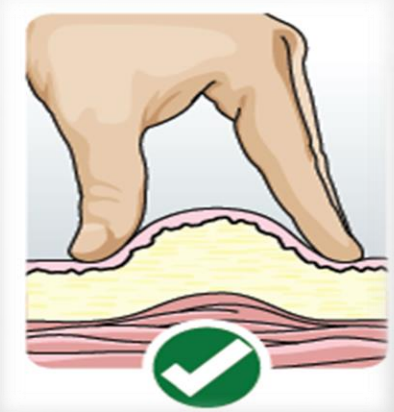
Recommendation 4.1.3

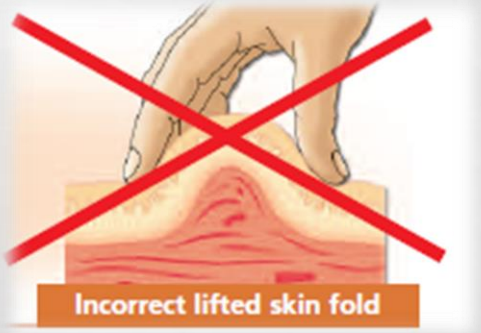
When using a needle of ≥ 8mm, patients should lift a skin fold using the thumb and index or middle finger that lifts subcutaneous tissue away from the muscle layer.(IIA)

- A open-label crossover prospective study
- 50 children whose BMI ≤ 60th percentile (mean BMI 16.8± 1.9kg/m^2) to compare 12.7 and 8mm needles regarding the occurrence of IM injections as assessed by USG. The frequency of IM injections was 86% with the 12.7 mm needles and 38% with the 8-mm needle.
- By using a two-finger pinch to obtain a skinfold, the mean distance from the skin to the muscle fascia increased by 80%

  Mean SQT$^-$ was 5.1± 1.8 mm (2-9.6 mm)

  Mean SQT$^+$ was 9.0 ±2.8 mm (3.6-15.7 mm)





Tubiana-Rufi, N., N. Belarbi, L. Du Pasquier-Fediaevsky, M. Polak, B. Kakou, L. Leridon, M. Hassan, and P. Czernichow (1999). "Short needles (8 mm) reduce the risk of intramuscular injections in children with type 1 diabetes." *Diabetes Care* 22.10: 1621-625.

Recommendation 4.1.3

When using a needle of ≥ 8mm, patients should lift a skin fold using the thumb and index or middle finger that lifts subcutaneous tissue away from the muscle layer.(IIA)

- An observational study (Cat II)
- **Aim:** to assess the insulin injection location by USG in 64 hospitalized DM children
- **Design:** Measured skin surface to muscle with & without skin fold, then determined the location of insulin deposit by 12.7mm syringe 90° to the skin surface with skin fold in the thigh or arm by children or parents as usual

Table 1 : Comparisons (univariate analysis) of the data between the group of children who had intramuscular injections and the group who had subcutaneous injections

Parameter studied	Intramuscular injection	Subcutaneous injection	P value
Sex : (M/F)	15/3	16/25	0.002
Percentage of children	31	69	---
Injection site (thigh/arm/gluteal/ombilical)	7/10/1/0	23/15/2/1	NS
Injection device (syringe/pen)	16/2	36/5	NS
Person injecting (child/parent/team member)	9/6/3	23/12/6	NS
Angle between needle and skin (degrees) (90/45)	16/2	39/2	NS
Skinfold for injection (yes/no)	17/1	40/1	NS
Length of the needle (mm) (12.7/16)	17/1	39/2	NS
Chronological age (years)	10.3 (1)	11.2 (0.6)	NS
Duration of diabetes (years)	3.1 (0.7)	4.2 (0.4)	NS
Percentile of BMI	47 (8)	72 (4)	0.004
Distance from skin surface to muscle fascia without a skinfold (mm)	5.6 (0.6)	11 (0.7)	< 0.0001
Distance from skin surface to muscle fascia with a skinfold (mm)	8.1 (0.9)	15.9 (0.8)	<0.0001
Volume of insulin injected (µl)	432 (58)	444 (44)	NS

Data are means ± SE, %, or *n*. *n* = 59

↑ **By 44.6%**

Polak, M., M. Beregszaszi, N. Belarbi, K. Benali, M. Hassan, P. Czernichow, and N. Tubiana-Rufi. "Subcutaneous or intramuscular injections of insulin in children. Are we injecting where we think we are?" *Diabetes Care* 19.12 (1996): 1434-436.

Recommendation 4.1.3

When using a needle of ≥ 8mm, patients should lift a skin fold using the thumb and index or middle finger that lifts subcutaneous tissue away from the muscle layer.(IIA)

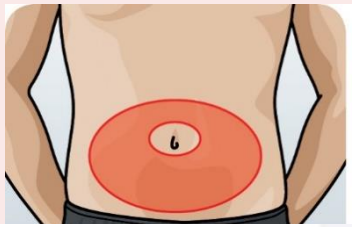
- 32 patients aged 4.3-17.9. In most boys the distance from skin to muscle fascia was < 12.5mm at all sites except the buttock. Most girls had SC fat layers of > 12.5 mm except over the calf, where perpubertal girls had little SC fat.

- The distance from skin to muscle fascia was increased by 3mm (0-5mm) when a skinfold was raised, a change of 19% (0-38%).



Smith, C. P., M. A. Sargent, B. P. Wilson, and D. A. Price. (1991)"Subcutaneous or intramuscular insulin injections." *Archives of Disease in Childhood* 66.7: 879-82.

Lifting a skin fold



- Lifting a skinfold in the abdomen horizontally nearly doubles the skin-to-muscle distance (192 ± 16%)

d
33±10%

in skin-to-
0% (22±6%)

ocutaneous
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Pinching increased the subcutaneous fat thickness more in the abdomen than the thigh



臺灣胰島素注射指引 2018

Hofman PL, Lawton SA, Peart JM, et al. An angled insertion technique using 6-mm needles markedly reduces the risk of intramuscular injections in children and adolescents. Diabetic Medicine 2007; 24: 1400-1405

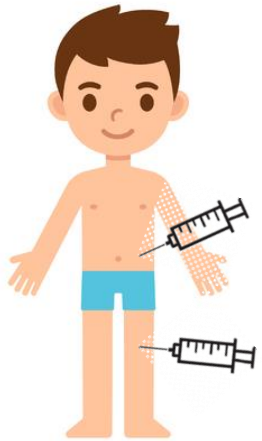
Finding 2

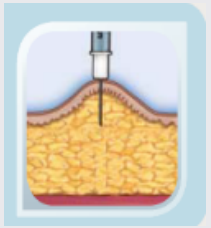
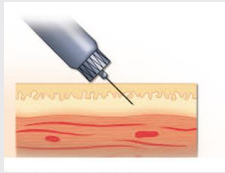
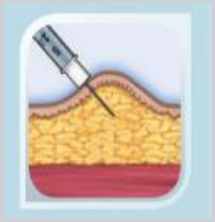
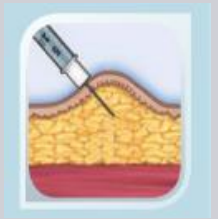
45° vs pinch up



- IM injection risk is substantially reduced with a 45° insertion angle (Hirsch et al, 2014)
- An angled 6-mm needle technique reliably injects into the subcutaneous fat (Hofman PL et al, 2007)
- Vertical injection may reflect pressure on the skin that lead to a skin depression of 1-2mm and causing higher than expected incidence of IM injections (Hofman PL et al, 2007)
- For leaner subjects, and particularly males, have <10mm subcutaneous fat thickness over the thighs, recommended that thigh injections should be avoided unless using 6-mm needles with an angle insertion (Hofman PL et al, 2007)
- A 45-degree angled 6-mm and 8-mm needle insertion penetrates approximately 4.2 mm (Hofman PL et al, 2007) and 5.6 mm (Hofman PL et al, 2007; Wang W et al 2016)

When using a needle of ≥ 6 mm, patients should inject at 45°



Study 1		Study 2	
 6mm	32% IM 22% muscle fascia	 6mm	3% IM 11% muscle fascia
 8mm		 6mm	No IMI

Hofman, P. L., S. A. Lawton, J. M. Peart, J. A. Holt, C. A. Jefferies, E. Robinson, and W. S. Cutfield. "An Angled Insertion Technique Using 6-mm Needles Markedly Reduces the Risk of Intramuscular Injections in Children and Adolescents." Diabetic Medicine 2007; 24.12 :1400-405

Children and slender patients should use 4 mm needles and may require a skin fold lift

Bibliographic Citation	Design	Sample size & characteristics	Intervention	Findings	Limitations	Evidence level and quality
#56 Lo Presti D et al, 2012	Cross-sectional study	n= 101 T1 children: age 2-6, 7-13, and 14-17 yr	The thickness of skin and subcutaneous tissue was measured by ultrasound in all injection sites	The safest needle for all children appears to be the 4-mm pen needle. However, when used in children age 2-6yr, it should be used with a pinched skin fold	• Involved single pediatric diabetes centre in Italy • All subjects with mean BMI 16.9,19.9 and 21.4 only. No comparison to overweight and obese	II
#39 Hirsch L et al, 2014	Post hoc analysis	n=388 US adults with widely varying BMI and age >18 with diabetes for ≥1 year	Standardized ultrasound measurement at ST and SCT at injection site	Very thin ones or young children, in whom a skinfold may be applied	• 42% of subjects studied had a BMI of >30kg/m, and few subjects were thin • Children and adolescents who were not evaluated • IM injection risk estimates are based on anatomic study, needle insertions were not performed.	II

Finding

4-mm needle ± pinch up

- The youngest group is at highest risk (Lo Presti D et al, 2012)

Table 4. The estimated incidence of SC and IM injections by age groups

Needle lengths (mm)	SC	IM	Percentage of IM injections (%)
Expected injection destinations through 90° insertion			
	Age 2–6 yr (total n = 248)		
4	198	50	20.2
5	134	114	46.0
6	83	165	66.5
8	40	208	83.9
12.7	7	241	97.2
	Age 7–13 yr (total n = 392)		
4	374	18	4.6
5	320	72	18.4
6	243	149	38.0
8	136	256	65.3
12.7	24	368	93.9
	Age 14–17 yr (total n = 168)		
4	164	4	2.4
5	141	27	16.1
6	110	58	34.5
8	57	111	66.1
12.7	6	162	96.4

IM, intramuscular; SC, subcutaneous.

- A 4mm needle cannot be inserted at angle because of physical characteristics of the needle length and hub (Hirsch L et al, 2014)

How should insulin injection be performed?

Reuse of needle and syringe	**Reuse of needles and syringes should be avoided.**[2,16,22,46,57,60,74,76,84] • Prevention of damage to the skin • Prevention of a painful injection • Reduction of the risk of the occurrence of lipodystrophy • Reduction of the risk of infection	IIA

Reuse of needles and syringes should be avoided

Bibliographic Citation	Design	Sample size & characteristics	Intervention	Findings	Limitations	Evidence level and quality
#86 Zabaleta-del-Olmo E, et al, 2016	Systematic review and meta-analysis	25 studies	Systematic review. Searched from the inception to December 2015, with no language restrictions	• 5 studies showed no association between infection at site of injection and reuse of needles • 5 cross-sectional studies showed an association between lipohypertrophy and needle reuse • Pooled data of 2 studies with no evidence of heterogeneity between them showed more perceived pain among reusers • Reusing a pen needle or disposable syringe-needle was not associated with worse glycaemic control • Currently **no clear scientific evidence to suggest for or against the reuse of needles** for subcutaneous injection		I

Finding

Reuse of needles and syringe

Most best-practice guidelines recommend against any reuse because of the possible adverse effects -> other factors: duration of insulin therapy, type of insulin, characteristics of the needles, injection technique used, or appropriate rotation of injection sites

- A meta-analysis of 25 studies could not give a conclusion regarding whether needle reuse was acceptable
- **Infection**/ clinical signs of infection at injection sites: reusing needles was not associated with local infection
- **Lipodystrophy**: these studies were cross-sectional and showed inconsistent results
- 5 studies showed a statistically significant association between the presence of lipohypertrophy and reuse of needles; however, these studies were highly heterogeneous, making the available evidence inconclusive
- **Pain**: 3 cross-sectional studies and 3 trials. Only 1 of these studies showed a statistically significant association between increased perception of pain and reuse of needles
- **Glycaemic control**: 3 cross-sectional studies: no association

Recommendation 4.2
Reuse of needles and syringes should be avoided. (IIA)

- 215 diabetics using insulin for at least 2 yrs
- Lipohypertrophy was observed in 20.3% of diabetics who changed their needle at every injection, this proportion was 51.2% in those who changed needles every 2-3 injections, 75% in those that changed every 4-5 injections and 100% in those changed only when the cartridge was finished.

Reduction of the risk of the occurrence of lipodystrophy

Vardar, B., and S. Kizilci. "Incidence of lipohypertrophy in diabetic patients and a study of influencing factors." *Diabetes Research and Clinical Practice* 77.2 (2007): 231-36.

Factors influencing lipohypertrophy and the status of lipohypertrophy

	Lipohypertrophy status						
	Present		Not present		Total		
	Number	%	Number	%	Number	%	
Gender							
Women	69	50.4	68	49.6	137	100.0	0.43837 ($p > 0.05$)
Men	35	44.9	43	55.1	78	100.0	
Education							
Elementary	54	58.1	39	41.9	93	100.0	0.02520 ($p < 0.05$)
High School	38	44.2	48	55.8	86	100.0	
University	12	33.3	24	66.7	36	100.0	
BMI							
Normal	29	40.3	43	59.7	72	100.0	0.09965 ($p > 0.05$)
Overweight	49	57	37	43	86	100.0	
Obese	26	45.6	31	54.4	57	100.0	
Needle change frequency							
At every injection	15	20.3	59	79.7	74	100.0	0.0000 ($p < 0.05$)
At every two–three injections	42	51.2	40	48.8	82	100.0	
At every four–five injections	36	75	12	25	48	100.0	
When cartridge is finished	11	100	–	–	11	100.0	
Length of needle							
8 mm	78	47.6	86	52.4	164	100.0	0.66954 ($p > 0.05$)
5 mm	26	51	25	49	51	100.0	
Change of site frequency							
A different site at every injection	30	76.9	9	23.1	39	100.0	0.0000 ($p < 0.05$)
A week at each site	30	23.8	96	76.2	126	100.0	
Haphazardly	19	90.5	2	9.5	21	100.0	
Using only one site	25	86.2	4	13.8	29	100.0	
Duration of insulin use							
0–5 years	8	12.1	58	87.9	66	100.0	0.0000 ($p < 0.05$)
6–10 years	24	40.7	35	59.3	59	100.0	
11–15 years	44	77.2	13	22.8	57	100.0	
16–20 years	28	84.8	5	15.2	33	100.0	

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Original article

Prevalence and risk factors of lipohypertrophy in insulin-injecting patients with diabetes

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Abstract

Introduction. – Our objective was to assess the frequency of lipohypertrophy (LH) and its relationship to site rotation, needle reuse, glucose variability, hypoglycaemia and use of insulin.

Methods. – The study included 430 outpatients injecting insulin who filled out a wide-ranging questionnaire regarding their injection technique. Then, a diabetes nurse examined their injection sites for the presence of LH.

Results. – Nearly two-thirds (64.4%) of patients had LH. There was a strong relationship between the presence of LH and non-rotation of sites, with correct rotation technique having the strongest protective value against LH. Of the patients who correctly rotated sites, only 5% had LH while, of the patients with LH, 98% either did not rotate sites or rotated incorrectly. Also, 39.1% of patients with LH had unexplained hypoglycaemia and 49.1% had glycaemic variability compared with only 5.9% and 6.5%, respectively, in those without LH. LH was also related to needle reuse, with risk increasing significantly when needles were used > 5 times. Total daily insulin doses for patients with and without LH averaged 56 and 41 IU/day, respectively. This 15 IU difference equates to a total annual cost to the Spanish healthcare system of > €122 million. This was also the first study in which the use of ultrasound allowed the description of an "echo signature" for LH.

Conclusion. – Correct injection site rotation appears to be the critical factor in preventing LH, which is associated with reduced glucose variability, hypoglycaemia, insulin consumption and costs.

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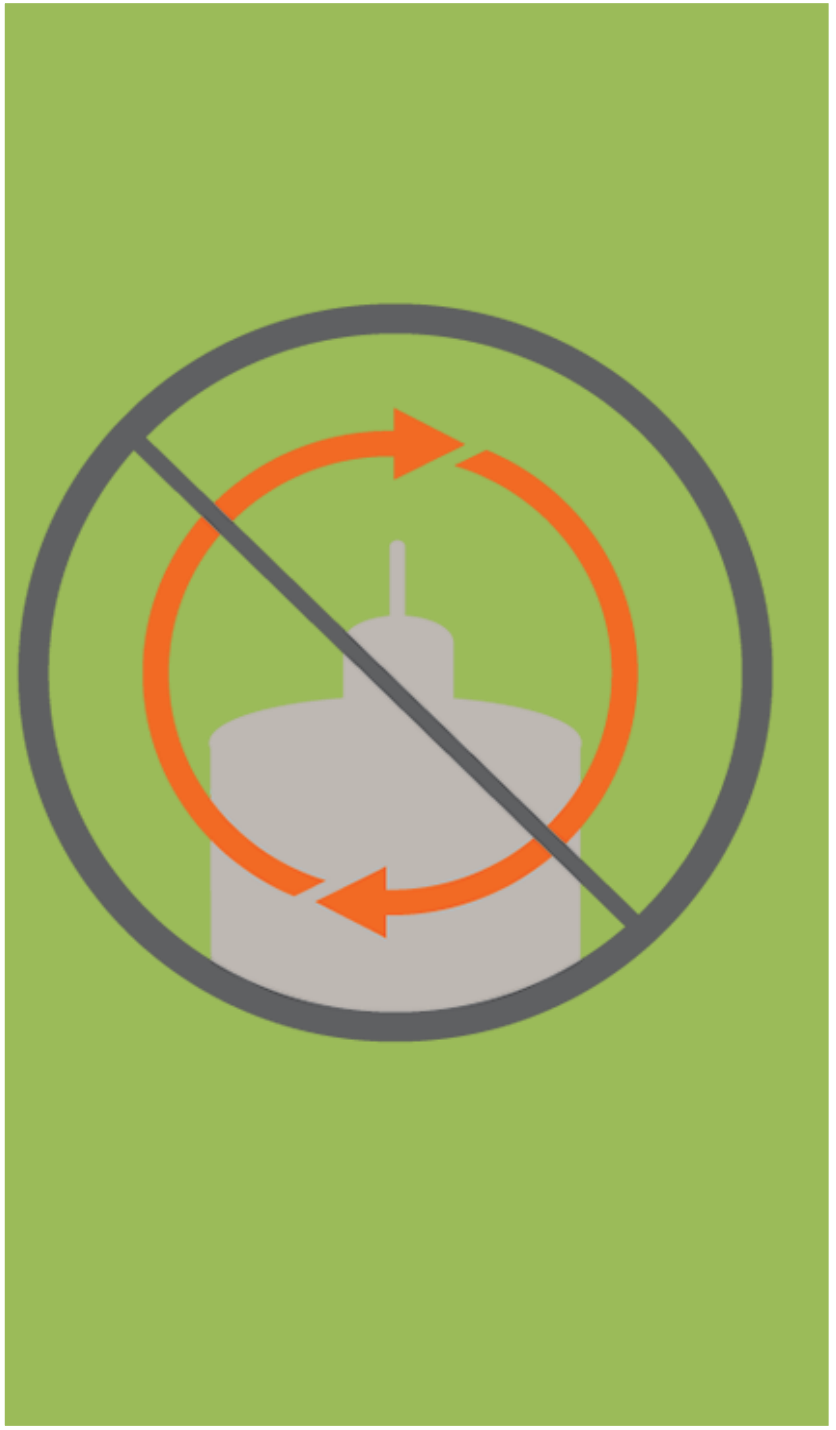


Table 4
Number of times needles reused in relation to presence of lipohypertrophy (LH).

Times needle used	LH (*n*)	No LH (*n*)	Ratio of LH/no LH[a]
1	109	81	**1.3**
2	38	33	**1.2**
3	37	12	*3.1*
4	20	9	*2.2*
5	18	7	*2.6*
6–10	55	10	5.5

[a] Subgroups are indicated by the bold, italic and normal fonts; there were no within-subgroup statistical differences, but between subgroup differences were $P < 0.05$.

How should insulin injection be performed?

Length of time and the needle remains in the tissue	1. Syringe should be removed following the completion of injecting.[4]	IIB
	2. The pen needle should be kept a hold-in-time for at least 10 seconds after the dose is fully delivered.[2,3,4,74]	IIA

How should insulin injection be performed?

Disposal of needle and syringe	1. When using a pen device, the pen needle should be removed from the device immediately after administering the insulin.[2,15,29,42,46,]	IIA
	2. Under no circumstance should pen device needles and syringes be directly disposed into public rubbish. [2,19]	IIIA
	3.Patients should be taught to dispose of pen needles and syringes properly.[7,19,46,74,88]	IIB

Patients should be taught to dispose of pen needles and syringes properly







The Government of the Hong Kong Special Administrative Region, Environmental Protection Department. Clinical Waste Management .Retrieved from www.epd.gov.hk/epd/clinical waste/nonflash/english/faq/general.html

- Used needles should be placed in a puncture-resistant container and label them as sharps before disposing them with other household waste.



Patients should be taught to dispose of pen needles and syringes properly

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28/10/2020 (週三) 下午5:02

Dear Annie Leung,

Thank you for your enquiry dated 26.10.2020.

Needles generated from injection in medical practice (e.g. at clinics) are classified as clinical waste, whereas those generated from self-injection by patients (e.g. at home) are classified as non-clinical waste.

In the former case, the used syringe together with the needle will be the responsibility of the healthcare service provider, who produces the clinical waste by conducting injection, to dispose of it properly according to section 3 of the Waste Disposal (Clinical Waste)(General) Regulation.

In the latter case, that is your patient's case, the syringe and the needle generated from self-injection by patients at home are not regulated under the aforesaid Regulation. The waste can therefore be disposed of with general refuse. That said, a common practice would be putting the syringes and needles in a puncture-resistant container labelled with "Sharps Inside" before disposal.

Regards,

Martin LEE
Territorial Control Office
Environmental Protection Department
Tel: 3107 8418

----- Forwarded by Martin WT LEE/EPD/HKSARG on 27/10/2020 11:12 -----

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Advice sought

Thank you