Highlight on Which sites should be used for insulin injection?

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2. Which sites should be used for insulin Injection?

Areas for injection

1. The appropriate injection areas are different for different individuals, and professional advice should be provided.[32,70] (II A)
2. Usual areas include abdomen, upper arm, thigh and buttock.[2,16,22,35,38,48,58,76] (II A)
3. The recommended areas for insulin injection should include:
    - Abdomen, avoiding umbilicus[2,16,35,38,58] (III B)
    - Thigh, lateral and anterior aspect[32,36,48,70] (II B)
    - Buttock, upper lateral quarter[32,35,70,76] (II B)
    - Arm, upper lateral and posterity part[32,48,70] (II B)

Areas for injection

1. The appropriate injection areas are different in individual and professional assessment should be required.[32,70] (II A)

This statement is supported by 2 experimental studies.

Gibney, M.A., Arce. C.H., Byron, K.J. & Hirsch , L.J. " Skin and Subcutaneous Adipose Layer Thickness in Adults with Diabetes at Sites Used for Insulin Injections: Implications for Needle Length Recommendations." Current Medicine Research & Opinion 26.6 (2010): 1519-530.

Experimental Study

388 adults with diabetes (in three BMI group)

Ultrasound measurements of ST and SCT for each subject on four injection areas.

The results showed the great variability in subcutaneous thickness in the same anatomic site, in the gender, in the different BMI.

Therefore the injection areas should require professional assessment in individual.

Areas for injection

1. The appropriate injection areas are different in individual and professional assessment should be required.[32,70] (II A)

Smith, C.P., Sargent, M.A., Wilson, B.P.M. & Price D.A. "Subcutaneous or Intramuscular Insulin Injection" Archives of Disease in Childhood 66 (1991): 879-822.

Experimental study

32 diabetic children

Used ultrasound to measure the distance from the skin to muscle fascia

Result:

- Girl > Boy
- Pubertal >Pre-pubertal

The results showed the great different subcutaneous fat layer in boys and girls, also pubertal and pre-pubertal, therefore the injection areas should require professional assessment in children.

Areas for injection

2. Usual areas include abdomen, upper arm, thigh and buttock. [2,16,22,35,38,48,58,76] (II A)

This statement is supported by 2 epidemiology studies, guidelines, position statement, teaching letter, education Journal.

Coninck, C.D., Frid, A., Gaspar,R., Hicks, D., Hirsch, L., Kreugel, G., Liersch., J., Letondeur, C., Sauvanet, J., Tubiana, N. & Strauss, K. "Results and analysis of the 2008-2009 Insulin Injection Technique Questionnaire Survey." Journal of Diabetes a (2010): 168-179.

Epidemiology study

4352 type 1 and type 2 patients from 171 centers and 16 countries in Europe

Data: Sept 2008 – June 2009

The common injection sites

- Abdomen 88% > Thigh 59% > Arm 29% > Buttock 16%

Areas for injection

2. Usual areas include abdomen, upper arm, thigh and buttock. 2,16,22,35,38,48,58,76 (II A)

Strauss, Kenneth, Heidi De Gols, Irene Hannet, Tuula-Maria Partanen, and Anders Frid. "A Pan-European Epidemiologic Study of Insulin Injection Technique in Patients with Diabetes." Practical Diabetes International 19.3 (2002a): 71-76.

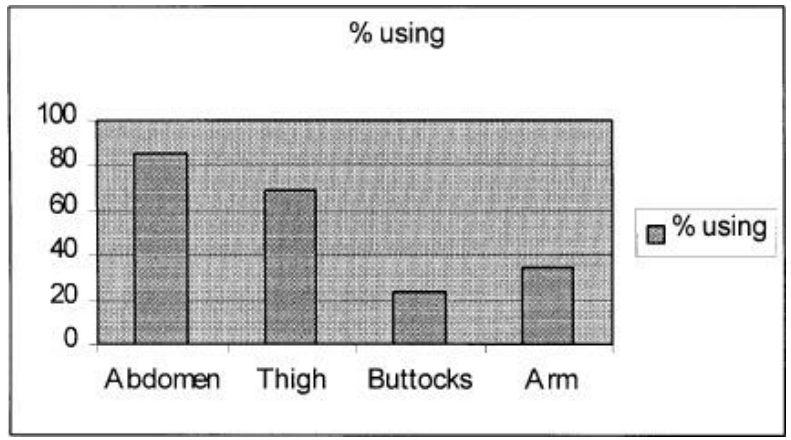
Epidemiologic study

1002 type 1 and type 2 patients at 22 sites in 7 Europe countries

Data collection in 18 months from Oct 98 – Mar 2000

The common injection sites

- Abdomen > Thigh >
  Upper arm > Buttocks



Areas for injection

3. The recommended areas should include:
    - Abdomen, avoiding umbilicus[2,16,35,38,58] (III B)

This statement is supported by guidelines, teaching letter and education Journals.

Areas for injection

3. The recommended areas should include:
    - Thigh, upper lateral and anterior aspect [32,36,48,70](IIB)

This statement is supported by 1 randomized single blind study, 2 experimental studies, guidelines, teaching letter.

Henriksen, J. E., M. S. Djurhuus, A. Vaag, P. Thye-Ronn, D. Knudsen, O. Hother-Nielsen, and H. Beck-Nielsen. "Impact of Injection Sites for Soluble Insulin on Glycaemic Control in Type 1 (insulin-dependent) Diabetic Patients Treated with a Multiple Insulin Injection Regimen." *Diabetologia* 36.8 (1993): 752-58.

Randomized single blind study

Insulin dose adjusted by diabetologist who were unaware of the injection site

49 type 1 patients – 3 groups

Sc thigh, IMI thigh & Sc abdomen wall

Used Ultrasound to differentiate the IMI or Sc thigh injection – mean thickness of the sc tissue was 10.6mm (5.5 -18.4) was larger in the medial and proximal part of the thigh than the lateral and distal part of the thigh (11.9 $\pm$0.6 vs 8.8$\pm$0.5mm)

Areas for injection

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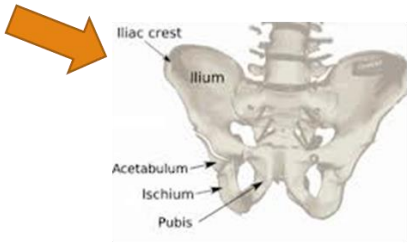
Gibney, M.A., Arce. C.H., Byron, K.J. & Hirsch , L.J. " Skin and Subcutaneous Adipose Layer Thickness in Adults with Diabetes at Sites Used for Insulin Injections: Implications for Needle Length Recommendations." Current Medicine Research & Opinion 26.6 (2010): 1519-530.

Experimental Study

388 adults with diabetes (in three BMI group)

Ultrasound measurements of ST and SCT for each subject on four injection areas.

- Anterior upper thigh – mid-distance between the iliac crest and the top edge of the patella





Areas for injection

3. The recommended areas should include:
    - Thigh, upper lateral and anterior aspect [32,36,48,70](IIB)

Smith, C.P., Sargent, M.A., Wilson, B.P.M. & Price D.A. "Subcutaneous or Intramuscular Insulin Injection" Archives of Disease in Childhood 66 (1991): 879-822.

Experimental study

32 diabetic children

Used ultrasound to measure the distance from the skin to muscle fascia

Anterior thigh – the anterior aspect of the thigh in the midline halfway between the anterior superior iliac spine and superior aspect of the patella

Lateral thigh – the lateral aspect of the thigh halfway between the anterior superior iliac spine and superior aspect of the patella

Areas for injection

3. The recommended areas should include:
    - Buttock, upper lateral quarter[32,35,70,76] (II B)

This statement is supported by 1 experimental study and guidelines.

Smith, C.P., Sargent, M.A., Wilson, B.P.M. & Price D.A. "Subcutaneous or Intramuscular Insulin Injection" Archives of Disease in Childhood 66 (1991): 879-822.

Experimental study
32 diabetic children
Used ultrasound to measure the distance from the skin to muscle fascia
Buttock – the point in the centre of the upper outer quadrant of the buttock.

Areas for injection

3. The recommended areas should include:
   - Arm, upper lateral and posterity part[32,48,70] (II B)

This statement is supported by 2 experimental studies and education journal.

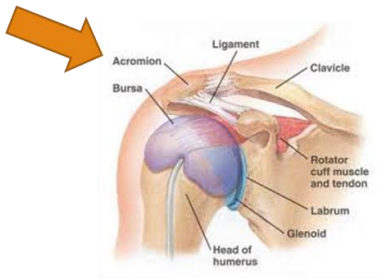
Gibney, M.A., Arce. C.H., Byron, K.J. & Hirsch , L.J. " Skin and Subcutaneous Adipose Layer Thickness in Adults with Diabetes at Sites Used for Insulin Injections: Implications for Needle Length Recommendations." Current Medicine Research & Opinion 26.6 (2010): 1519-530.

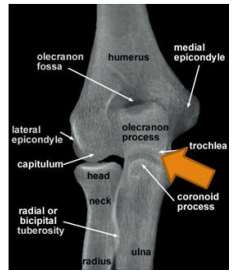
Experimental Study

388 adults with diabetes (in three BMI group)

Ultrasound measurements of ST and SCT for each subject on four injection areas

Rear upper arm - midsection between the acromion and olecranon processes





Areas for injection

3. The recommended areas should include:
    - Arm, upper lateral and posterity part[32,48,70] (II B)

Smith, C.P., Sargent, M.A., Wilson, B.P.M. & Price D.A. "Subcutaneous or Intramuscular Insulin Injection" Archives of Disease in Childhood 66 (1991): 879-822.

Experimental study
32 diabetic children
Used ultrasound to measure the distance from the skin to muscle fascia
Outer arm – the lateral aspect of the arm one third of the way between acromion of the scapula and the head of radius

Rotation of Injection Points

1. Injection points should be rotated in the same area when using the same type of insulin.[8,11,48,50,70] (II B)
2. Injection points should be rotated regularly.[9,44,63,75] (II A)
3. Patients should be taught a systematic rotation scheme.[6,29,38,44,58,75,84] (IIA)
4. Regular reviewing of injection technique and injection site should be undertaken and documented[4,21](II B)

Rotation of Injection Points

1. Injection points should be rotated in the same area when using the same type of insulin.[8,11,48,50,70] (II B)

This statement is supported by cross over study, 2 experimental studies, critical review and education journal.

Bantle, J. P., M. S. Weber, J. Thow, and P. Home. "Rotation of the Anatomic Regions Used for Insulin Injections and Day-to-day Variability of Plasma Glucose in Type 1 Diabetic Subjects." Journal of the American Medical association, 1990;263:1802-06

Bantle (1990) had done the cross over study in 12 type 1 patient for 3 days.

The patient assigned to inject on abdomen for 3 days and rotated with arm, abdomen and thigh for other 3 days.

The result showed the values of mean SD and mean variance of plasma glucose were less than in abdomen injection period. Abdomen injection period 2.7 ± 0.2mmol/L VS Rotation period 3.7 ± 0.3mmol/L ($p>0.001$)

Rotation of Injection Points

1. Injection points should be rotated in the same area when using the same type of insulin.[8,11,48,50,70] (II B)

Koivisto, V.A. & Feling,P. "Alterations in Insulin Absorption and in Blood Glucose Control Associated with Varying Insulin Injection Sites in Diabetic Patients." Annals of Internal Medicine 92 (1980): 59-61.

Experimental study

7 type 1 diabetes patient

Injected I-labelled short acting insulin (Actrapid) in abdomen, thigh and arm to measure the disappeared insulin

The result showed the absorption from the abdominal wall was 86% greater than from the leg ($P<0.005$) and 30% greater than arm ($P<0.05$). Absorption from the arm was 40% greater from the leg ($P<0.05$)

Rotation of Injection Points

1. Injection points should be rotated in the same area when using the same type of insulin.[8,11,48,50,70] (II B)

Smith, C.P., Sargent, M.A., Wilson, B.P.M. & Price D.A. "Subcutaneous or Intramuscular Insulin Injection" Archives of Disease in Childhood 66 (1991): 879-822.

Experimental study

32 diabetic children

- We suggest using a single anatomical region for injections to reduce day to day variation of absorption of insulin

Rotation of Injection Points

2. Injection points should be rotated regularly.[9,44,63,75] (II A)

This statement is supported by epidemiology study and observational studies .

Strauss, Kenneth, Heidi De Gols, Irene Hannet, Tuula-Maria Partanen, and Anders Frid. "A Pan-European Epidemiologic Study of Insulin Injection Technique in Patients with Diabetes." *Practical Diabetes International* 19.3 (2002a): 71-76.

Appropriate rotation schemes not only reduce the size of lipos but allow the patient to reduce their daily insulin consumption by up to 50%

Independent risk factors for lipohypertrophy were found to be failure by patient to check injection sites regularly, failure to rotate sites.

Rotation of Injection Points

2. Injection points should be rotated regularly.[9,44,63,75] (II A)

Ibarra, L. Saez-De, and F. Gallego. "Factors Related to Lipohypertrophy in Insulin-treated Diabetic Patients: Role of Educational Intervention." Practical Diabetes International 15.1 (1998): 9-11.

Observational Study

150 insulin treated patients

Collected clinical data including HbAc1, blood glucose profile and injection sites evaluation by diabetes nurse

The result showed rotation was an independent risk of lipohypertropy and irregular glycemic profile.

Table 5. *Results of the multiple logistic regression model, showing those variables independently related with the risk of lipohypertrophy*

Variable	Regression coefficient	Standard error	p value
Sex	1.3999	0.4713	0.0037
Type of diabetes	–1.6260	0.6745	0.0178
Rotation	–1.1689	0.5444	0.0342
BMI	0.1786	0.0885	0.0463

Rotation of Injection Points

2. Injection points should be rotated regularly.[9,44,63,75] (II A)

Partanen, T-M, and A. Rissanen. "Insulin Injection Practices." Practical Diabetes International 17.8 (2000): 252-54.

Observational Study

100 type 1 diabetes

Data were collected by a structured questionnaire with a few open-ended questions.

Results: 23% patients used a very small injection area, the size of a stamp. Cross-tabulation showed the patients with most findings were those with poor metabolic control (HbA1c >8.6%) and small injection areas.

Rotation of Injection Points

3. Patients should be taught a systematic rotation scheme. [6,29,38,44,58,75,84] (IIA)

This statement is supported by epidemiology study, observational study and guidelines.

Strauss, Kenneth, Heidi De Gols, Irene Hannet, Tuula-Maria Partanen, and Anders Frid. "A Pan-European Epidemiologic Study of Insulin Injection Technique in Patients with Diabetes." *Practical Diabetes International* 19.3 (2002a): 71-76.

Recommendation:

Health care worker must be given an organized scheme of site rotation.

Health care worker must check injection sites regularly and intervene appropriately before these lesions appear or enlarge.

Rotation of Injection Points

3. Patients should be taught a systematic rotation scheme. [6,29,38,44,58,75,84] (IIA)

This statement is supported by epidemiology study, observational study and guidelines.

Ibarra, L. Saez-De, and F. Gallego. "Factors Related to Lipohypertrophy in Insulin-treated Diabetic Patients: Role of Educational Intervention." Practical Diabetes International 15.1 (1998): 9-11.

Observational Study

150 insulin treated patients

Collected clinical data including HbAc1, blood glucose profile and injection sites evaluation by diabetes nurse

Recommendation :1) to establish with the patient organized rotation system for insulin injection 2) to examine injection sites regularly

Table 4. *Relation of lipohypertrophy to unstable glycaemic profile*

	Stable profile	Unstable profile
Systematised rotation	22	8
Non-systematised rotation	51	47
Chi-squared = 3.4; p value = 0.06		
	Stable profile	**Unstable profile**
Present lipohypertrophy	28	41
Absent lipohypertrophy	45	14
Chi-squared = 15.1; p value = 0.0001		

Rotation of Injection Points

4. Regular reviewing of injection technique and injection site should be undertaken and documented[4,21](II B)

This statement is supported by systemic review and case report.

Annersten, Magdalena, and Ania Willman. "Performing Subcutaneous Injections: A Literature Review." Worldviews on Evidence-Based Nursing 2.3 (2005): 122-30.

Systematic review

Implications for research and practice

Injection site should be systematically inspected and routinely documented.

THANK YOU