The Forum for Injection Technique (FIT) UK provides evidence-based best practice recommendations for people with diabetes who are using injectable therapies and for clinicians who care for people with diabetes using injectable therapies. Through these recommendations, people with diabetes can achieve the best possible health outcomes by ensuring that the correct dose of medication is delivered to the correct injection site, using the correct technique. FIT UK understands that written guidelines alone will not change clinical practice unless appropriately implemented. FIT UK is committed to engaging in a range of initiatives including research, education and support for healthcare professionals (HCPs) carers and people with diabetes.

Our Objectives

- To review the injection and infusion techniques currently being used by people with diabetes
- To identify, and provide information on ‘Best Practice’ and education programmes available in the UK
- To raise awareness of the impact that existing and emerging research regarding injection technique may have on health outcomes and wellbeing for those with diabetes who require subcutaneous injection therapy
- To facilitate opportunities, in which best practice can be discussed, developed, implemented and evaluated across the UK
Over 16 years ago a small pioneering group of medical and nursing professionals gathered for the first time to explore the evidence for optimal injection technique.

FIT UK was established following the 3rd International Injection Technique meeting in Athens 2009. Informed by the results of the International Injection Technique Survey (1) and contemporaneous injection technique evidence from around the world, the diabetes specialist nurses, founders of FIT UK were determined to share their findings and their passion for optimal injection technique not only in the UK but around the world.

FIT UK has grown from a single entity based in the UK and is now represented in countries including:

- Africa
- Canada
- India
- Europe
- Latin America
- Middle East
- Pacific Rim including
  - Australia and New Zealand
  - China
  - Japan
  - Korea
  - Malaysia
  - Philippines
  - Singapore

Diabetes UK estimates that more than one in sixteen people in the UK have diabetes (diagnosed or undiagnosed) and that there are four million people living with diabetes in the UK. This figure is projected to rise to five million people by 2025. (2)

Diabetes diagnosis rates are equivalent to:
- Around seven hundred people every day (2)
- Thirty people every hour (2)
- One person every two minutes (2)
Everyone with Type 1 Diabetes Mellitus (T1DM) will need insulin from diagnosis (3). Currently there are 400,000 people in the UK with T1DM and over 29,000 of them are children. The number of people diagnosed is increasing by 4 percent every year and most commonly in children under five years old. (4)

New and emerging evidence shows that optimal injection technique is critical to improving health outcomes. A pioneering study by Blanco (5) demonstrated that almost two thirds of patients have lipohypertrophy due primarily to incorrect or no rotation of injection sites. Of the patients with lipohypertrophy 39.1% had unexplained hypoglycaemia and 49.1% had glycaemic variation. Patients with lipohypertrophy were found to be using much more insulin than those without, estimated to cost the Spanish Healthcare system 122 million Euros per year in excess insulin usage.

A study by Grassi (6) demonstrated that a multimodal approach to injection technique education and support could reduce glycated haemoglobin (HbA1c) by 6 mmol/mol (0.58%) in patients treated with insulin. Interestingly this was achieved using less insulin and without any weight gain. The development of FIT UK and the subsequent UK Injection and Infusion Technique Recommendations 4th Edition have been supported by BD Europe. They have also been endorsed by Diabetes UK along with the pharmaceutical companies whose therapies include subcutaneous injections of insulin and glucagon-like peptide-1 receptor agonists (GLP-1 receptor agonists).
FIT UK’s overarching mission is:

‘To support people with diabetes using injectable therapies to achieve the best possible health outcomes that are influenced by correct injection technique’.

To date FIT UK has delivered many education programmes and produced the First UK Injection Technique Recommendations (2010) and Safety Recommendations (2012) which have been distributed and accessed online by many thousands of health care professionals. FIT UK has also produced a range of educational support materials and e-learning modules.

FIT UK is committed to supporting the implementation of the recommendations and developing them further as new evidence emerges. We welcome any comments, suggestions and active participation in ensuring that the updated recommendations remain relevant and useful for now and in the future.

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Contents

Preface and Objectives 3
Introduction 4
FIT UK 5
Endorsements 8
KEY 10

1.0 Psychological Challenges of Injections 11
2.0 Therapeutic Education 15
3.0 Injection Process 16
4.0 Injectable Therapies 22
5.0 Lipohypertrophy 23
6.0 Injection Issues 26
7.0 Pregnancy 27
8.0 Technology 28
9.0 Safety 30
10.0 Golden Rules 33

References 39
Contributors 46
Abbreviations 47
Endorsements

“Diabetes UK both welcomes and supports the FIT initiative. Good injection technique leads to good blood glucose control which is vital in preventing the long term complications of diabetes. As so many people with diabetes are now being prescribed injectable medication, this is a timely and important enterprise which will bring great benefit to them.”

Simon O’Neill, Director of Health Intelligence. DIABETES UK

“Advances in the treatment of diabetes have led to an increase in the number of injectable therapies available. Correct technique is of paramount importance in order to ensure the benefits of injectable therapies such as insulin and GLP-1s. The Forum for Injectable Therapy (FIT) provides comprehensive evidenced based guidelines to improve the process and education of self-injection technique for people with diabetes. As a company committed to improving the care of patients with diabetes, Lilly UK welcomes the FIT initiative as an important step in supporting diabetes care in the United Kingdom.”

Ian Dane, Senior Director, Eli Lilly & Company

“Novo Nordisk fully endorse the FIT initiative. The benefits of modern injectable medications for the treatment of diabetes can only be fully realised through the use of correct injection technique. Novo Nordisk believes it is imperative that Healthcare Professionals understand the importance of good injection technique and convey this to people with diabetes under their care. FIT is a superb initiative, from leading professionals in the diabetes care, which will make a big difference in this area.”

Kirsty Tait, Diabetes Marketing Director, Novo Nordisk Ltd.
Sanofi are a company who strive to improve the care for people with diabetes who are using insulin and GLP-1 therapy by providing a range of injectables. We are proud to support the FIT (Forum for Injection Technique) initiative which is aiming to improve current practice through demonstration of best practice and the sharing of scientific evidence. We, too, appreciate the importance of good injection technique in ensuring people with diabetes who are using injectable therapy achieve the most benefit from their medication and wish FIT every success. We look forward to working with FIT in the future.”

Sanofi Nicky Barry, Divisional Director Diabetes,

“AstraZeneca are pleased to support the FIT initiative. We are striving to provide medicines which can provide better outcomes for people with Type 2 Diabetes but this can only be achieved when they are used correctly. Adoption of the FIT guidelines in clinical practice will help ensure that the best outcome is obtained from all injectable medicines.”

Jay Ark, Head of Injectable at Diabetes Marketing, AstraZeneca

“Becton Dickinson has been supporting the ground breaking and inspirational work of the Forum for Injection Technique for over 8 years. The new 4th Edition of The UK Injection and Infusion Technique Recommendations follows the Worldwide FITTER Congress held recently in Rome 2015. During this worldwide event which included 183 participants from 54 countries, delegates reviewed results data from a worldwide injection technique survey, and this wealth of new data provided the evidence to help formulate the best practice recommendations you will find in this UK 4th Edition.

Our BD mission; ‘Improving the quality of daily life for people with diabetes, through access to innovative solutions’ is incredibly important to all who work at BD, and BD is proud to endorse the dedicated expert work that FIT UK undertakes. BD welcomes the publication of the 4th Edition of The UK Injection and Infusion Technique Recommendations and commends the FIT Board and all the dedicated clinicians from all over the UK for their great achievement.”

Loïc Herve, Business Unit Director Diabetes Care BD
A Scientific Advisory Board (SAB) (Athens 2009) led the review of available evidence and decided that for the strength of a recommendation the following scale would be used:

- **STRONGLY RECOMMENDED**
- **RECOMMENDED**
- **UNRESOLVED ISSUE**

For the scientific support the following scale was used.

1. At least one randomised controlled study.
2. At least one non-randomised (or non-controlled or epidemiologic) study.
3. Consensus expert opinion based on extensive patient experience.

A number of significant studies have been published in the intervening years since 2009. Therefore FITTER has conducted a further review of critical evidence and included this within the 4th Edition of the New Injection and Infusion Recommendations. The body of evidence has been subjected to the rigour of the strength scale of recommendations as above however with a slightly modified KEY for the scientific support:

For the scientific support the following modified scale was used.

1. At least one rigorously performed study, peer-reviewed and published.
2. At least one observational, epidemiologic or population-based study.
3. Consensus expert opinion based on extensive patient experience.

Thus each recommendation is followed by both a letter and number (i.e. A2). The letter indicates the weight a recommendation should have in daily practice and the number, its degree of support in the medical literature. The most relevant publications bearing on a recommendation are also cited. There are few randomised clinical trials in the field of injection technique (compared, for example, with blood pressure control) so judgements such as ‘strongly recommended’ versus ‘recommended’ are based on a combination of the weight of clinical evidence, the implications for patient therapy and the judgement of the group of experts.

These recommendations apply to the majority of people with diabetes using injectable therapy, but there will inevitably be individual exceptions for which these recommendations must be adjusted.

Acknowledgment

1.0 Psychological Challenges of Injections

1.1 Emotional and Psychosocial Issues

1 Show empathy by addressing the patients’ emotional concerns first. The healthcare professional (HCP) should explore worries and barriers to treatment and acknowledge that anxiety is normal when beginning any new medication, especially injection therapy. (7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18)  

2 People, with diabetes should be encouraged to express their feelings about injecting, particularly their fears; frustration, anger and struggles.  

3 Patients of all ages should be reassured that this is a learning process and the health care team is there to help along the way. The message is: ‘you are not alone, we are here to help you; we will be supporting you until you are comfortable and confident giving yourself an injection’.  

4 With all patients it is important to explain that insulin is not a punishment or failure. Insulin when used correctly is the most effective treatment we have for managing blood glucose. For patients with Type 1 Diabetes Mellitus (T1DM) it is the primary treatment and for patients with Type 2 Diabetes Mellitus (T2DM), it may be used in addition to oral therapy but may also be used in combination with GLP-1 receptor agonists to improve blood glucose control. For patients with T2DM it is important they understand the natural progression of the condition and that insulin therapy is a part of the logical progression in its management. (19, 20, 7)  

5 Inform patients that improving their blood glucose levels may make them feel better in the long term. Many patients report an overall improvement in their health and well-being when taking insulin. Managing blood glucose levels with insulin helps to prevent long-term complications’. (8, 21)  

6 All patients should be supported to self-manage as much as possible and be involved in designing their regimen to fit their lifestyle. This could include basal bolus therapy, carbohydrate counting, using insulin pens and insulin pumps.  

11
1.0 Psychological Challenges of Injections

1.2 Strategies for Reducing Fear, Pain, and Anxiety

1 Include caregivers and family members in the planning and education of the person who is injecting where appropriate and agreed by the individual.

2 Tailor the therapeutic regimen to the individual needs of the patient.

3 Have a compassionate and clear approach when teaching correct injection technique.

4 Demonstrate the correct injection technique to the individual and assess their ability to self-inject.

5 In the case of fear provoked by seeing needles consider the use of devices which hide the needle.

6 Consider the use of vibration, cold temperature or pressure to suppress pain during injection.

7 If bleeding or bruising occur, assess and reassure the patient that these do not affect the absorption of insulin or overall blood glucose control. If bruising continues or haematomas develop, observe the injection technique and suggest improvements (e.g. correct rotation of injection sites).

8 Children have a lower threshold for pain. The HCP should ask about pain. For young children consider distraction techniques or play therapy (e.g. injecting the child’s own soft toy or doll). Older children respond better to cognitive behavioural therapies (CBT).

9 CBT includes relaxation training, guided imagery, graded exposure, active behavioural rehearsal, modelling and positive reinforcement as well as appropriate rewards.

10 Fear and anxiety can be significantly reduced by having the person (parent and child) give themselves a dry injection.

11 Most are surprised at how relatively painless the injection is.

12 On rare occasions the use of injection ports may help reduce fear of injections and associated pain. Fig 1

With kind permission. i-Port Advance® injection port is a registered trademark. © 2016 Medtronic MiniMed, Inc. All Rights Reserved.

Figure 1: Medtronic Port in situ.
1.0 Psychological Challenges of Injections

13 Insulin pens with very short needles may be more acceptable to patients than the syringe and vial. This should be discussed with the person (and family) when teaching injection technique. The 4 mm pen needle is reported by patients to be less painful than longer needles. (8,28,29,30) A 2

14 If patients occasionally experience sharp pain on injection they should be reassured that the needle may have touched a nerve ending which happens randomly and will not cause any damage. A 3

15 If pain persists the HCP should see the patient and evaluate their injection technique. A 3

1.3 Tips for Injection Education

1 Demonstrate the correct injection technique to the person (and family.) Then ask the patient (and family) to demonstrate the correct technique. A 3

2 Advise that insulin in use is kept at room temperature to make for a more comfortable injection. Cold insulin often produces more pain. A 3

3 Advise that the skin should be clean and dry before injecting. Patients do not need to use a disinfectant (e.g. alcohol swab) on the skin, but if they do, they should allow it to dry completely before injecting. A 3

4 Use needles of the shortest length (4mm), smallest diameter (highest gauge number), and the tip with the lowest penetration force to minimize pain. (31) A 1

5 Insert the needle through the skin in a smooth but not jabbing movement. Pain fibres are in the skin and going through the skin too slowly or too forcefully may increase the pain. (31) A 1

6 Inject the insulin slowly ensuring that the plunger (syringe) or thumb button (pen) has been fully depressed and all insulin has been injected. With pens the patient should count to 10 after the button has been fully depressed before withdrawing the needle. A 1

7 Use a sterile, new needle for each injection. (5,32,33,34,35, 36,37,38,39,40,41,42,43) A 1

8 HCPs should teach the importance of rotation and agree a rotation pattern with the patient when initiating injection therapy. (5) A 1

9 Insulin will not be well-absorbed if it is always injected into the same area. (5) (44) A 1

13
1.0 Psychological Challenges of Injections

10 It is important to move injections at least 1 cm (half an inch) away from the previous injection. (5) A 1

11 Use all injection sites appropriate to the patients' preference on the body including the back of the arms, buttocks, thighs and abdomen. (5) A 1

12 If the same injection site is used repeatedly lipohypertrophy may develop (lumpy, firm and enlarged tissue). The insulin will not be absorbed correctly if injected into these areas. (5,45,46) A 1

13 If pain is experienced when injecting large volumes of insulin the dose may need to be divided into two injections of a smaller volume or the concentration of insulin may need to be increased. A 1

14 Insulin pens, pen cartridges and vials should not be shared in order to prevent the transmission of infectious diseases. (32,33,47,34,35,36, 37,38,39,40,41,42,43) A 1
2.0 Therapeutic Education

2.1 Educational Content

1 The HCP should spend time exploring patient (and other care-givers’) anxieties and barriers to the injecting process and insulin itself. (48,19) A 3

2 At the beginning of injection therapy the HCP should discuss each of the essential topics and ensure this information has been fully understood, and this should be assessed at least every year thereafter. (12) A 3

3 The essential injection technique topics include:
   - the injectable therapy regimen
   - the choice and management of the devices including safety devices
   - the choice, care and self-examination of injection sites
   - correct injection techniques (including site rotation, injection angle and possible use of lifted skin folds)
   - Resuspension of insulin where appropriate
   - injection complications and how to avoid them
   - optimal needle lengths
   - Safe disposal of used sharps
   - hypoglycaemia, where appropriate (19,20,21,28,48,49,50,51)

4 Instructions should be given in both verbal and written form, individually tailored to the needs of the person. A 3

5 Level of knowledge should be assessed and observed, and all aspects of injection technique including injection sites inspected and palpated, if possible at each visit but at least every year. This should be documented in the patient’s records. (48,49,51) A 3

2.2 Role of the Health Care Professional

1 Teach patients (and other care-givers) how to inject correctly and addressing the many psychological hurdles the patient may face when injecting or infusing, especially at the initiation of treatment. (50,48) A 3

2 Is to understand the anatomy of insulin delivery sites in order to help patients avoid intramuscular (IM) injections or infusions and ensure that injections and infusions are consistently given into the subcutaneous (SC) tissue, without leakage/backflow or other complications. (52,53,54,55,56) A 3

3 Is to have knowledge of the time action profile of the different types of insulin and GLP-1 receptor agonists and the absorption profiles from different injection sites. (57,58,59,60) A 3
3.0 Injecting Process

3.1 Injection Site Care

1. The site should be inspected by the patient prior to injection. Injections should then be given in a clean site using clean hands. Fig 2 (61,62,63)

2. Soiled skin should be cleaned according to basic common standards with soap and water. If alcohol is used to clean the site, the skin must be allowed to dry completely before the injection is administered. Fig 3 (64,65)

3. Disinfection of the site is usually not required although local decisions may be taken in a clinical setting to do so. (32,66,67,68,69)

4. Patients should never inject into sites of lipohypertrophy, inflammation, oedema, ulceration or infection, nodules, scar tissue, tattoos, hernias and stomas. (70,52, 71,72,73,(74,75,76,77,78)

5. Patients should not inject through clothing. (64)
3.0 Injecting Process

3.2 Re-suspension of Cloudy Insulin

1. Cloudy insulins (e.g. NPH and pre-mixed insulins) must be gently rolled and inverted ten times each but not shaken until the crystals go back into suspension and the solution becomes milky white. Fig 4 and Fig 5 (79,80,81,82,83,84) A 2

2. Invert the pen or vial and roll (a full rotation cycle between the palms). Inversion and/or rolling should be performed a total of 20 times immediately before every injection with cloudy insulin. A 3

3. Visually confirm that the re-suspended insulin is sufficiently mixed after each rolling and inversion, and repeat the procedure if crystal mass remains in the cartridge. (82,83,85,86) A 2

4. Vigorous shaking should be avoided since this produces bubbles which reduce accurate dosing. (82,83,85) A 2

5. Store unopened insulin in a refrigerator where freezing is unlikely to occur, as per manufacturer’s instructions. (87,88) A 2

6. After initial use, insulin (in pen, cartridge or vial) should be stored at room temperature for up to 30 days or according to manufactures recommendations and within expiry date. Premixed insulin pens and some of the newer insulins may vary – check individual manufacturer’s recommendations. (89,90) A 2

7. Storage of Insulin
Insulin IN USE should be stored below thirty degrees Celcuis but do not refrigerate however, Insulin NOT IN USE should be stored in a refridgerator (two to eight degrees Celcuis), do not freeze, do not expose to direct sunlight. It should be allowed to warm up for approximately fifteen minutes prior to use for the first time. (87,88) A 2

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Figure 4: Re-suspension of cloudy insulin
Figure 5: Re-suspension of cloudy insulin
3.0 Injecting Process

3.3 Needle Length

1. The 4mm pen needle inserted perpendicularly (at ninety degrees) is long enough to penetrate the skin and enter the subcutaneous tissue, with little risk of intramuscular (or intradermal) injection. Therefore it should be considered the safest pen needle for adults and children regardless of age, gender and Body Mass Index (BMI). (9,92,93,94,95)

2. The 4 mm pen needle may be used safely and effectively in all obese patients. Although it is the needle of choice for these patients, a 5mm needle may be acceptable. (96,97,98,99,100,101,102)

3. The 4 mm pen needle should be inserted perpendicular (at ninety degrees) to the skin surface and not at an angle, regardless of whether a skin fold is raised. Fig 6 (103,104)

4. Very young children (6-years old and under) and extremely thin adults (BMI <19) should use the 4mm needle by lifting a skin fold and inserting the needle perpendicularly into it. Others may inject using the 4 mm needle without lifting a skin fold. (58,100,105,103)

5. When any syringe needle is used in children, adolescents or slim to normal weight adults (BMI 19-25), injections should always be administered into a lifted skin fold. (57,58,53,106,93,100,101,102,105,94,56,103,104,107,108,109,110,111,112,113,114,115,116,117,118,119,120,121,122,123,124,125,126,127,128,129,130,131)

6. Use of syringe needles in very young children (less than 6 years old) and extremely thin adults (BMI <19) is not recommended, even if they use a raised skin fold, because of the excessively high risk of intramuscular (IM) injections. (57,58,53,106,93,100,101,102,105,94,56,103,104,107,108,109,110,111,112,113,114,115,116,117,118,119,120,121,122,123,124,125,126,127,128,129,130,131)

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Figure 6: Intramuscular injection (IM)
3.0 Injecting Process

7 Children still using the 5mm pen needle should inject using a lifted skin fold. But children using pen needles ≥5mm should be changed to 4 mm pen needles if possible; and if not, should always use a lifted skin fold. (58,100,105,103) [A 2]

8 If arms are used for injections with needles ≥6mm long, a skinfold must be lifted, which requires injection by a third party. (103) [A 2]

9 Avoid indenting the skin by excessive pressure during injection, as the needle may penetrate deeper than intended and enter the muscle. [B 3]

10 Health care authorities and payers should be alerted to the risks associated with using syringe or pen needles ≥6mm in children. (35,106,110) [A 2]

3.4 Lifting a Skin Fold

1 Each injection site should be examined individually and a decision made as to whether lifting a skin fold is required, taking into account the needle length used. The recommendation should be provided to the patient in writing and documented in their care plan. [A 3]

2 The lifted skin fold should not be squeezed so tightly that it causes skin blanching or pain. [Fig 7 A 3]

3 The optimal sequence should be:
   • Lift a skin fold;
   • Inject insulin slowly at ninety degrees to the surface of the skin fold;
   • Leave the needle in the skin for a count of 10 after the plunger is fully depressed (when injecting with a pen);
   • Withdraw needle from the skin at the same angle it was inserted;
   • Release skin fold;
   • Dispose of used needle safely. [A 3]

Figure 7: Correct (left) and incorrect (right) ways of performing the skin fold.
3.0 Injecting Process

3.5 Needle Reuse

1. Syringe or pen needles should only be used once. Reusing insulin needles is not optimal injection practice and patients should be discouraged from doing so. Fig 8 (1,68,78,132,133,134)

2. There is an association between needle reuse and the presence of lipohypertrophy, although a causal relationship has not been proven. Patients should be made aware of this association (and also the association between reuse and pain or bleeding). (68,70,135)

3.6 Rotation of Injecting Sites

1. Injections should be systematically rotated in such a way that they are spaced at least 1cm from each other in order to avoid repeat tissue trauma. Fig 9 (90,136,47,137)

2. One scheme with proven effectiveness involves dividing the injection site into quadrants using one per week and moving quadrant to quadrant in a consistent direction (e.g. clockwise). Fig 10 (138)

3. Patients should be taught an easy-to-follow rotation scheme from the onset of injection therapy. This may be adjusted as needed while therapy progresses. The HCP should review the site rotation scheme with the patient at least once a year. (139,140,141,44,142,143,144,145)
3.0 Injecting Process

3.7 Correct Use of Pens

1 Pens should be primed (observing at least a drop at the needle tip) according to the manufacturer’s instructions before the injection in order to ensure there is unobstructed flow and to clear needle dead space. Once flow is verified, the desired dose should be dialled and the injection administered. (29,146)

2 Pens and cartridges are for a single patient and should never be shared between patients due to the risk of biological material from one patient being drawn into the cartridge and then injected into another person. (30,32)

3 Needles should be safely disposed of immediately after use and not left attached to the pen. This prevents the entry of air (or other contaminants) into the cartridge as well as the leakage of medication, either of which can affect dose accuracy. (30,33,147,148,149,150)

4 Pen needles should be used only once. (62,63,68,106,151,152,153,154)

5 The thumb button should only be touched once the pen needle is fully inserted. After that the button should be pressed along the axis of the pen, not at an angle. (155)

6 After pushing the thumb button completely in, patients should count slowly to 10 before withdrawing the needle in order to get the full dose and prevent the leakage of medication. (79,33,147,149,156,157)

7 Pressure should be maintained on the thumb button until the needle is withdrawn from the skin in order to prevent aspiration of patient tissue into the cartridge. (158,159)

3.8 Correct Use of Syringes

1 When drawing up insulin from an insulin vial, the air equivalent to the dose (or slightly greater) should be drawn up first and injected into the vial to facilitate insulin withdrawal. Ensure that the syringe to be used is an INSULIN syringe. Use of any other type of syringe can cause serious harm. “All regular and single insulin (bolus) doses are measured and administered using an insulin syringe or commercial insulin pen device. Intravenous syringes must never be used for insulin administration” RRR 2010. (253)

2 If air bubbles are seen in the syringe, patients should tap the barrel to bring them to the surface and then remove the bubbles by pushing up the plunger.
3.0 Injecting Process

4.0 Injectable therapies

4.1 Human Insulins

1 Intramuscular (IM) injections of Neutral pH suspension of crystalline insulin, protamine and zinc (NPH) and long acting insulin must be strictly avoided due to the risk of hypoglycaemia. (160,161,162,163)

2 The abdomen is the preferred site for soluble human insulin since absorption of this insulin is fastest there. (164,165,166,167,95)

3 Soluble human insulin /NPH mix should be given in the abdomen to increase the speed of absorption of these short-acting insulins, in order to cover post-prandial glycaemic changes (56)

4 If there is risk of nocturnal hypoglycaemia, NPH and soluble human insulin mixes given in the evening should be injected into the thigh or buttock as these sites have slower absorption of NPH. (168,169,170)

4.2 Insulin Analogues and GLP-1 agents

1 Rapid-acting insulin analogues may be given at any of the injection sites, as absorption rates do not appear to be site-specific. (171,172,173,174,175)

2 Rapid-acting analogues should be given subcutaneous and not IM. (172,173,176)

3 Patients may inject long-acting insulin analogues in any of the usual injecting sites as absorption rates do not appear to be site specific. (107)

4 Patients using non-insulin injectable therapies should follow the recommendations already established for insulin injections with regards to needle length, site selection and site rotation. (148,177)
5.0 Lipohypertrophy (LH)

Correct Examination For Detection Of Lipohypertrophy:
The following points are helpful when performing the physical examination for Lipohypertrophy (LH). Having gained consent, the examination should be performed at least once a year on all persons injecting insulin. For those found to have LH lesions, the examinations should be performed even more frequently. Fig 12

5.1 Setting
1. Patient should be asked about abnormalities at injection sites (what, where and how long); this should guide examinations but not limit it to one area.
2. Patient must then disrobe to only underclothes. A chaperone may be needed in some cultures.
3. Room must be warm to prevent patient chilling (this ensures patient comfort but also prevents shivering and muscle tension which can interfere with the examinations).
4. Light should be oblique to the skin (not overhead); the use of an examining light with an adjustable neck is ideal; light should be shined onto skin surfaces at an angle of 30-45 degrees.

5.2 Positioning Patient
1. Patient should be lying down on back (to relax abdominal muscles) with knees bent (to relax thigh [quadriceps] muscles) and arms folded over chest (to relax arm muscles).
2. If there is no table, an alternative is for the patient to be sitting, with knees bent and arms relaxed in lap.

5.3 Positioning Professional
1. Hands must be washed and warmed before touching patient.
2. If no adjustable light is available, healthcare professional (HCP) can wear head lamp or use flashlight.
3. If patient is sitting HCP needs to do the examinations seated.

Figure 12: Examples of lipohypertrophy
5.0 Lipohypertrophy

5.4 Technique for Visual Examination

1. Inspect site with lamp first, adjusting its angle to be able to detect any subtle risings or depressions across the surface of the skin.

2. Lipohypertrophy (LH) is usually manifested as a raised or mound-like, convex pattern with no change in skin colour or hair distribution; occasionally it can be manifested as only a shiny or hyper-pigmented (especially in dark-skinned persons) area and/or an area of hair loss.

3. If detected, gain consent and mark centre point with pen so that area can be palpated later.

5.5 Technique of Palpation

1. After hands are warmed by rubbing them together or washing in warm water, apply gel (ultrasound gel or another water-soluble lubricant for clinical use) to the injecting area and palpate with the tips of the fingers, working in towards the injecting area with light massage-like motions (forward thrusts or circular sweeps).

2. Lipohypertrophy is manifest by a change in the subcutaneous (SC) tissue, which is replaced by a harder, and more rubbery or less bouncy tissue.

3. Often the edges of this abnormal area are clearly demarcated and it is easy to feel the transitional zone, which appears as a ‘step-up’ from the surrounding soft tissue.

5.6 Measuring and Documenting the Lipohypertrophy

1. With the patient’s consent and using skin safe marker pen, mark the exact position of the lesion on the patient’s skin so that the patient can clearly see the extent of the lesion and avoid injecting into it.

2. Measure the distance along its largest dimension (usually the longest diameter) in mm and record in patient’s chart.

3. Photograph the lesion from a distance of 1 meter without flash, using the light from an oblique source so as to reveal surface contours once consent has been given.

4. Use the measurements and photograph to follow progression of the lesion long-term.

5. Patient should be taught to do the visual and palpation examination monthly (using soap or hand lotion as a lubricant) and to report any change to the HCP.
5.0 Lipohypertrophy

5.7 Role of Ultrasound in Lipohypertrophy
1. Ultrasound (US) has been used in various LH studies but its exact role has yet to be defined, either for diagnosis or management of the disorder.

2. US appears to be more sensitive and specific than clinical examination in early clinical studies, but this remains to be confirmed.

3. An US ‘signature’ for LH may exist and ongoing studies are attempting to define the various image profiles of LH.

5.8 Diagnosis and Management of Lipohypertrophy
1. Sites should be examined by the HCP at least once a year or more frequently if lipohypertrophy is already present. (142,48) A 2

2. The physical examination for lipohypertrophy is ideally performed with the patient lying down with injection areas fully exposed and any tight or restrictive clothing loosened. But in circumstances that preclude this, examination of the patient sitting, standing or partially-clothed is acceptable. A 3

3. Patients should be taught to inspect their own sites and should be given training in site rotation, correct injection technique as well as in detection and prevention of lipohypertrophy. (178,179,180,181,182,183,184,66,67,69,72,73,44,185,186,187,188,189,190,191) A 2

4. After obtaining patient consent, making two ink marks at opposite edges of the lipohypertrophy with a single-use skin-safe marker (at the junctions between normal and lipohypertrophic tissue) will allow the lesion to be measured or photographed and its size recorded for future assessment. Recording and measuring is important but facilities or time may not always be available. (5,192,193) A 2

5. Patients should be encouraged by education and guidance not to inject into areas of lipohypertrophy until the next examination by an HCP. Advise using larger injection areas and do not reuse needles. (186,194,195,196,197) A 2

6. Switching injections from lipohypertrophic to normal tissue often requires a decrease in the dose of insulin injected. The amount of change varies from one individual to another and should be guided by frequent blood glucose measurements. (71,73,186,194,196) A 1
6.0 Injection Issues

6.1 Bleeding and Bruising
1 Patients should be reassured that local bleeding and bruising do not have adverse clinical consequences for the absorption of insulin or for overall diabetes management. Fig 13 (198) A 2
2 If bleeding and/or bruising are frequent or excessive, injection technique should be carefully assessed but this may be due to the presence of a coagulopathy or the use of an anticoagulant or antiplatelet agent. A 3

6.2 Leakage at Cartridge and Pen Needle (PN) Connection
1 Ensure that the pen needle (PN) is International Organization for Standardization (ISO) certified compatible with the insulin pen. A 3
2 Position the PN along the axis of the pen before screwing or snapping it on. A 3
3 Pierce straight through the septum of the cartridge. A 3

6.3 Skin Leakage
1 Use needles with thin-wall or extra thin-wall technology. (199,200) A 1
2 Count to 10 after the plunger is fully depressed before removing the needle from the skin. This allows enough time for the injected medication to spread out through the tissue planes and/or to cause the tissue to expand and stretch. (157,199,200) A 2
3 A small amount of skin leakage (little pearl of liquid at injection site) can be ignored. It is almost always clinically insignificant. (157,199,200) A 1
4 For patients who report frequent skin leakage, a direct observation of their self-injection is important to detect possible technique-related issues that can be modified. (157,199,200) A 2

Figure 13: Cluster of injection punctures.
6.0 Injection Issues

6.4 Dripping from the Needle

1. Use needles which have a wider inner diameter and improved insulin flow (e.g. Extra-thin wall needles). (201,31) A 1

2. Count to 10 after the plunger has been fully depressed before removing the needle from the skin. This is to allow time for forces to be transmitted through all pen parts to insulin column in the pen cartridge. Fig 14 (199) A 2

3. Larger doses may be split to reduce the volume of insulin. Consider using higher strength insulin for large doses to reduce volume. (199,202) A 2

Figure 14: Count to 10 before removing pen

7.0 Pregnancy

7.1 Pregnant Women

1. The abdomen is a safe site for insulin administration in pregnancy. Given the thinning in abdominal fat from uterine expansion, pregnant women with diabetes (of any type) should use a 4 mm pen needle. B 1

2. First trimester: Women should be reassured that no change in insulin site or technique is needed. B 3

3. Second trimester: Lateral parts of the abdomen can be used to inject insulin, staying away from the skin overlying the foetus. B 3

4. Third trimester: Patients may use the thigh, upper arm or lateral flanks of the abdomen to inject themselves. B 3
8.0 Technology

8.1 Needle Inner Diameter

1 High flow rate needles (extra-thin wall) needles have been shown to be appropriate for all injecting patients. Their obstruction, bending and breakage rates are the same as for conventional quality needles (extremely low), and they offer distinct flow advantages. Fig 15

8.2 Insulin Infusion Sets (IIS) for Continuous Subcutaneous Insulin Infusion (CSII)

1 Population studies suggest that CSII cannulae should be changed every 48–72 hours in order to minimise infusion site adverse events and potential metabolic deterioration. (203,204,20,206) A 1

2 All CSII patients should be taught to rotate infusion sites along the same principles that injecting patients are taught to rotate injection sites. (183,207) A 1

3 Any CSII patients with unexplained glucose variability including frequent hypoglycaemia/hyperglycaemia should have infusion sites checked for lipohypertrophy, nodules, scarring, inflammation or other skin and subcutaneous (SC) conditions that could affect insulin flow or absorption. (207) A 1

4 All CSII patients should have their infusion sites checked frequently or at least annually for lipohypertrophy by an HCP. (205,208) A 1

5 If lipohypertrophy is suspected, the patient should be instructed to stop infusing into these lesions and to insert the cannula into healthy tissue. (71,145,186,194,195,196,197) A 1

6 Silent occlusion of insulin flow should be suspected in any patient with unexplained glucose variability or unexplained hyperglycaemia. (203,208,209,210,211) B 2

7 If silent occlusion or flow interruptions are suspected CSII patients should be considered for alternative cannulae. (203,205,209,212) A 1

8 All CSII patients should be considered for the shortest needle/cannula available, along the same principles as insulin injectors, to minimise the risk of intramuscular (IM) infusion. (212) B 2

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Figure 15: thin inner diameter needle v thick walled needle.
8.0 Technology

9 The smallest diameter needle/cannula should be considered in CSII patients to reduce pain and the occurrence of insertion failure. (212)

10 Angled insertion sets should be considered in CSII patients who experience infusion site complications with perpendicular (ninety degree) infusion sets.

11 All CSII patients who experience a hypersensitivity reaction to cannula material or adhesive should be considered for alternative options (alternative sets, tapes or skin barriers).

12 All CSII patients who are lean, muscular or active and have a high probability of the cannula or tubing being dislodged may benefit from an angled infusion set (30-45 degree). (213)

13 All CSII patients who have difficulty inserting their infusion set manually for any reason should insert their infusion sets with the assistance of a mechanical insertion device. (213)

14 All CSII patients who become pregnant may require adjustments to their infusion sets, site locations and frequency of site changes.
9.0 Safety

9.1 Needlestick Injuries/ Blood-borne Infection Risk

1 Safety-engineered devices play a critical role in protecting injectors, pump users and downstream workers, for example refuse workers, cleaners and porters. Nurses and other HCPs must receive appropriate education and training in how to minimize risk, by following optimal techniques, using available safety devices and wearing protective clothing (e.g., gloves). (214)  A 1

2 Safety-engineered devices should be considered first-line choice if injections are given by a third party. Pen and syringes with needles used in these settings should have protective mechanisms for all needles and sharp ends of the delivery device. (215,216,217,218,219, 220,221,222,223,224)  A 2

3 The use of safety-engineered devices should be considered for certain autonomous home-injecting patients with diabetes (e.g. those known to be seropositive for Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV), children injecting at school, care homes and prisons). (216,225,226,227)  B 2

4 Patients with small children at home and/or sub-optimal sharps disposal options should also consider using safety-engineered devices. (215,217,218,220,221,228)  B 2

5 HCPs should be involved in the selection, trial and choice of devices used in their health care setting. Evaluation prior to adoption should include key specialists (e.g. experienced end users, infection prevention and control and occupational health). (229,215)  A 1

6 Health care settings where insulin pens are used must follow a strict one-patient / one-pen policy. (230)  A 2

7 The optimal safety-engineered device should provide protection for patients, caregivers and all others who may come in contact with the sharp device. (215,216,217,218,219,220,221,222,223,224)  A 1

8 Manufacturers must investigate all reported needlestick injuries (NSI) to determine if they are related to a device failure.  A 3

30 DATE PUBLISHED: October 2016
9.0 Safety

9. The use of shorter needles (e.g. 4 mm pen needles) without a skin fold is recommended to minimize the risk of needlestick injury (NSI) through a skin-fold. (93,102,130,231) 

10. If a lifted skin fold is used, the patient should ensure that finger and thumb are approximately 2.5 cm (1 inch) apart and should make the injection in the centre of the fold thus minimizing through-skinfold NSI risk. (231) 

11. NSI awareness campaigns should be carried out regularly and should include all persons in potential contact with medical sharps. (217,218,220,232,233) 

12. Needle recapping should not be done and manufacturers should design safety-engineered devices which make recapping impossible. Fig 16 and Fig 17 (215,217,218,220,221) 

13. Hospitals must encourage reporting of NSI and near misses and establish a 'no blame' culture. Central review of all NSI/near misses must take place regularly to allow for policy change and assess educational needs. (215,217,218,220,221) 

14. Review and evaluation of the effectiveness of education and training and of compliance to guidelines must be performed at regular intervals. A reporting system for non-compliance must be put in place. (215,216,217,218,220,221,222,223,224) 

15. Attention must be paid to the use of safety-engineered devices. If they are used incorrectly or not activated, they provide no additional risk reduction over conventional (non-safety) devices (may lead to dosing errors). (215,216,217,218,219,220,221,222,223,224)
9.0 Safety

16 Sharps containers must be easily accessible at the point of care beside the patient, prior to the injection or infusion. Containers should bear the warning, ‘Needles can seriously damage the health of others. Please ensure safe disposal’ or similar. Fig 18 (215,217,218,220,221,228)

18 First aid information ‘what to do in the event of a NSI’ should be readily available. All workers in possible contact with sharps should be aware of local safety and disposal regulations. Legal, societal and health related consequences of non-compliance should be reviewed. (135) A 2

17 While Hepatitis B Virus (HBV) vaccination should be population-wide, the minimum standard is its mandatory offering by the employer to all workers exposed to sharps. Vaccination status should be reviewed annually. (234) A 1

19 Safe disposal should be taught to patients, care-givers and all others who may come in contact with the sharp device from the beginning of injection or infusion therapy and reinforced throughout. (136) A 2

20 Potential adverse events of NSIs should be emphasized to the patients’ family, caregivers and service providers (e.g. refuse collectors and cleaners). A 3

21 Under no circumstance should sharps material be disposed of into the public refuse or rubbish system. A 3

Figure 18: Sharps container
10.0 Golden Rules

10.1 Psychological Issues around Insulin Therapy and Administration

1. All patients and care givers should be offered general, as well as individualised education/counselling which will facilitate optimal care.

2. Ensure all patients and carers are supported by their HCP using person-centred evidence-based psychological educational tools / strategies to achieve mutually-agreed goals.

3. Diabetes HCPs should be skilled in identifying psychological issues which impact on insulin therapy and administration.

4. HCPs must have a range of therapeutic behavioural skills to minimise the psychological distress and impact of insulin therapy.

5. Various methods of minimizing barriers, pain and/or fear of injection should be utilised in order to reduce psychological impact.

10.2 Injection Technique in Adults

1. Insulin and GLP-1 receptor agonists must be deposited into healthy subcutaneous tissue, avoiding the intradermal and intramuscular spaces as well as scars and lipohypertrophy.

2. 4mm pen needles are recommended for all adults regardless of age, gender or Body Mass Index (BMI). If patients need to use needle lengths > 4mm or a syringe (or where the presumed skin surface to muscle distance is less than the needle length) they must use a correctly-lifted skinfold to avoid intramuscular injections.

3. Recommended sites for injection are abdomen, thigh, buttocks, upper arms:
   - Abdomen within the following areas: 2cm above the symphysis pubis, 2cm below the lowest rib, 2cm away from the umbilicus and laterally at the flanks. (Pregnant women should avoid abdominal sites around the umbilicus during the last trimester)
   - Upper 3rd anterior lateral aspect both thighs
   - Upper, outer quadrants of buttocks
   - Mid 3rd posterior aspect of upper arm, if given by a third party
10.0 Golden Rules

4 Inspect site before injecting and avoid areas of lipohypertrophy.

5 Rotation of injection sites within an area is recommended:
   • Spacing injections approximately 1 cm breadth apart
   • Using a single injection site no more frequently than every 4 weeks when feasible.
   • Avoid mixing injection areas and insulin type

10.3 Injection Technique in Children and Young People

1 Insulin must be injected into healthy subcutaneous (SC) tissue, avoiding the intradermal (ID) and intramuscular (IM) tissue as well as lipohypertrophy, lipoatrophy and scar tissue.

2 Injections should avoid bony prominences by one to two centimetres. Sites, in order of preference are:
   • Upper outer quadrant of the upper buttocks
   • Abdomen, two centimetres away from umbilicus
   • Middle 3rd of the back of the upper arm
   • Upper outer 3rd of both thighs

3 Consideration should be given to the type of insulin and the time of day when selecting injection sites.

4 Correct rotation of injection sites must be followed at all times to prevent lipohypertrophy.

5 4mm pen needles should be used for all children and young people regardless of age, gender or BMI.

6 Children and young people are at risk of accidental IM injection particularly in the thigh; therefore, always use a lifted skinfold especially if using a pen or syringe with a safety needle attached.
10.0 Golden Rules

10.4 Treating and Preventing Lipohypertrophy

1. All HCPs in diabetes must be trained in correct injection technique and to correctly screen for lipohypertrophy and other site complications.

2. All patients, caregivers, and family members must be taught the techniques of correct injection or infusion at the initiation of therapy and at subsequent reviews, at least on an annual basis.

3. Injection sites should be checked by a HCP on a regular basis, at least annually or more often if LH has been detected.

4. All persons who self-inject/infuse insulin or other injectables must be taught to self-inspect sites and be able to distinguish healthy from unhealthy tissue.

5. Patients with lipohypertrophy who have been instructed to stop injecting/infusing into affected tissue must be:
   - Educated about the improved/changed absorption when injecting into normal tissue instead of lipohypertrophy
   - Advised that pain may be experienced when injecting into normal tissue
   - Encouraged by a HCP to monitor glucose levels frequently due to the risk of unexpected hypoglycaemia
   - Supported to reduce their insulin doses in line with glucose results, knowing that reductions often exceed 20% of their original dose
   - Changed to 4mm pen needles/8mm insulin syringes or the shortest needle length available to minimise accidental intramuscular risk due to using larger areas

- Clinicians must document lipohypertrophy and other site complications in patient records
- Patients should be encouraged to avoid injecting into lipohypertrophy or unhealthy sites
- Clinicians must monitor and record any area of lipohypertrophy to map change, possibly using the following tools:
  - Photography
  - Body maps with descriptors for size, shape, texture
  - Transparent graduated recording sheets.
- With patient consent, clinicians should mark the border of all lipohypertrophy and other site complications with skin-safe single-use markers and instruct patients to avoid using marked areas until instructed otherwise

STRONGLY RECOMMENDED
RECOMMENDED
UNRESOLVED ISSUE

1. At least one rigorously performed study, peer-reviewed and published
2. At least one observational, epidemiologic or population-based study
3. Consensus expert opinion based on extensive patient experience.
10.0 Golden Rules

6 All patients must be encouraged to correctly rotate injection/infusion sites and educated of the risks of reusing needles in order to minimise risk of injection site complications:

- Principles of correct rotation technique must be taught to patients and rotation technique assessed at least every year and more frequently if required
- Correct rotation ensures that injections are spaced out approximately 1 cm (a finger breadth) from each other and that a single injection site is used no more frequently than every 4 weeks when feasible.

10.5 Insulin Infusion Technique

1 Insulin infusion cannulae must be inserted into healthy subcutaneous tissue, avoiding underlying muscle as well as areas of skin irritation, scarring, lipohypertrophy and lipoatrophy.

2 If bleeding or significant pain occurs upon insertion, the set should be removed and replaced.

3 Preferred sites for infusion cannulae should be individualised and include:
   - Abdomen, avoiding bony prominences and umbilicus
   - Upper outer quadrant of the upper buttocks and flanks
   - Middle 3rd of the back of the upper arm
   - Upper outer 3rd of both thighs

4 Infusion cannulae sites should be rotated to avoid lipohypertrophy. This involves full rotation within each site.

5 Infusion cannulae should be changed within 72 hours.

6 If kinking occurs consider a shorter cannula or an angled or steel infusion set.

7 If silent occlusion, interuption in flow or unexplained hyperglycaemia occur, consider using a cannula with a side port.
10.0 Golden Rules

10.6 Needlestick Injuries and Sharps Disposal

1 All HCP, employers and employees must comply with relevant international, national and local legislation for the use of sharps.

2 Sharp medical devices present a potential risk for injury and transmission of disease. All HCPs, employers and employees must ensure the safest possible working environment by:

   • Conducting regular risk assessment in all situations where there is potential for exposure to sharps injury
   • Preventing and controlling risk by means of continuing education and training
   • Providing and using a means of safe disposal of used sharps conforming with National standards
   • Encouraging reporting of incidents

3 Safety-engineered devices must be used by all HCPs and by all 3rd party carers using sharps (e.g. injections, blood testing, infusion) in situations where a risk for disease transmission (i.e. Human Immunodeficiency Virus [HIV] and hepatitis) may be present, and in risky environments such as care homes, schools, and prisons.

4 Frequent and regular sharps awareness campaigns must be conducted by all employers for personnel at risk of contact with medical sharps.

5 Recapping of needles is strictly prohibited (except by the self-injector).

6 Where possible safety-engineered devices with passive activation should be used.

7 Insulin delivery by 3rd party carers or family member must be carried out using correct injection or infusion techniques and with safety-engineered devices which shield/guard the patient end of the needle at a minimum. Best practice for pen needles requires that both ends of the needle be protected.
10.0 Golden Rules

8 Safe disposal requires that:

- Correct disposal procedures and personal responsibility be taught to patients and care givers by the dispensing clinician (including pharmacists) and be regularly reinforced
- Safe sharps disposal systems and processes be present and known to all persons at risk of sharps contact (conforming to National standards)
- Environments where others are at risk of exposure to sharps (e.g. care homes, schools and prisons or around refuse workers and cleaners) be highlighted to the patient
- Patients diagnosed with blood bourne diseases such as Human Immunodeficiency Virus (HIV) or Hepatitis be supported to use safety-engineered devices and dispose of them safely
- Sharps should never be placed directly in public or household rubbish
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THE UK INJECTION AND INFUSION TECHNIQUE RECOMMENDATIONS


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213 EU Commission for Employment, Social Affairs and Inclusion, New legislation to reduce injuries for 3.5 million healthcare workers in Europe, 8th March 2010.

214 Article 3.2 says that where risk cannot be eliminated the employer shall take appropriate measures to minimise the risks. Appropriate measures to minimise the risks would include the provision by employers of safer needle devices. (Cf. NHS Employers, Implementation advice on sharps agreement, 12th October 2010)


228 The Health and Safety Executive, Health and Safety (Sharp Instruments in Healthcare) Regulations 2013: Guidance for employers and employees.


THE UK INJECTION AND INFUSION TECHNIQUE RECOMMENDATIONS


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# Abbreviations

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<tr>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>BMI</td>
<td>Body Mass Index (kg/m)</td>
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<tr>
<td>CBT</td>
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<td>centimetre</td>
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<td>CSII</td>
<td>Continuous Subcutaneous Insulin Infusion</td>
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<td>GLP-1 receptor agonist</td>
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<td>HbA1c</td>
<td>N-(1-deoxy)-fructosyl-haemoglobin, glycated haemoglobin</td>
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