Using disposable insulin syringes: lessons from Lucknow, India

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This article highlights the errors made by one adult patient with diabetes while self-administering insulin using plastic disposable syringes. Incorrect administration of insulin can result in serious injection site skin complications. All patients using insulin should acquire the correct information and skills needed for proper insulin administration. Here the author discusses some of the issues related to insulin administration while using disposable syringes.

This is a real story of Ramesh (name changed) who visited the author's diabetes centre in Lucknow, India, for the first time. The author noticed mistakes, which Ramesh made with regard to self-administering insulin, using plastic disposable syringes. These mistakes led to formation of multiple skin lesions (*Figure 1*) at the site of insulin administration (B/L thigh in this case).

Discussion

A large numbers of patients with diabetes in the developing world use insulin syringes to inject insulin, using disposable syringes, rather than an insulin pen. A reason for this is the difference in cost between the two modalities of insulin administration. The Ripudaman Singh group conducted a prospective observational study at the endocrine outpatient department of a university-affiliated teaching hospital in North India, in which they compared insulin pen devices with disposable plastic syringes (Singh, 2018). They interviewed patients using a self-made questionnaire after obtaining consent; patients were scored based on their answers. A total of 90 completed questionnaires (45 from each group) were obtained. All patients felt that treatment using a pen device was costlier when compared with using disposable syringes, with pen users spending Rs 1,756 (US$24) per month on their insulin therapy, as compared with disposable syringe users, who spent Rs590 (US$8) per month (Singh, 2018).

The main points to remember about insulin injection are highlighted in *Box 1*. Ideally, the area where the injection is to be given should be cleaned with an alcohol swab and then let the area dry. The next step is to pinch up a large area of skin and hold it firmly. With other hand, the person needs to hold the syringe like a pencil and push the needle straight into the pinched-up skin at a 90-degree angle followed by pushing the plunger all the way down. Thereafter one needs to let go of the skin, hold an alcohol swab near the needle and pull the needle straight out of the skin.

The person with diabetes must not rub the area after the injection and remember not to inject into skin that is red, swollen, itchy, or damaged. They should also avoid scars, moles, and the area around the belly button. They may use the same area of the body, but must change the spot for the shot each time to protect the skin over time. Furthermore they must wait approximately five seconds before pulling out the needle. It is important to follow

Box 1. Points to remember during insulin administration

The injection site should be clean, as should one's hands (Hansen, 2006)

4 mm pen needles, and 6 mm syringe needles are recommended for all adults, children and adolescents. Children <6 years of age, and very thin adults may inject perpendicularly into raised skin folds (American Diabetes Association, 2004)

Recommended sites are the abdomen, upper thighs, upper arms and upper buttock (Miwa, 2012). Persons using insulin should self-inspect their injection sites and screen for lipohypertrophy

Injection sites should be inspected and palpated by diabetes care professionals at least once a year, and more frequently if lipohypertrophy is detected (Ji, 2017). Needles should not be reused. Insulin pens, cartridges and vials should not be shared (Brown, 2016)

Safe disposal of insulin needles and ancillaries should be ensured (Pugliese, 2001).

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Figure 1. Ramesh with his lesions caused by inappropriate use of disposable insulin syringes

instructions from the doctor about the careful selection and rotation of injection sites on the body. Systematic switching of the injections from one site to another site and within the injection site is important as it helps maintain healthy injection sites, optimises insulin absorption and reduces the risk of lipohypertrophy (Yuan, 2016). The most commonly used sites for insulin injection are as follows: abdomen, upper arms, thigh,and buttocks. Some other important steps to be remembered are washing hands with soap and water before the injection. If needed, one should mix the insulin by slowly rolling the bottle between hands, not shaking the bottle vigorously. Injecting cold insulin can be painful. Finally the insulin must not be used if it looks lumpy or grainy, sticks to the bottle or seems to be discoloured.

Advantages of using insulin pen devices and conventional insulin syringes

Insulin pens are considered to offer a more convenient insulin delivery experience along with more accurate dosing as compared with insulin syringes (Tandon, 2017). Many believe that patients experience less pain while using insulin pens, due to the smaller gauge of the needles. Insulin pens are considered less intrusive and socially more acceptable and offer more flexibility because of the choice of a disposable or reusable option.

Insulin syringes have an advantage that they can be used for preparation from different manufacturers. The syringe barrel can be chosen based on the insulin dose. Patients can see the number and scale lines together to ensure accurate dosing and syringes allow the use of split-mix regimens. Syringes are indeed less expensive as compared with insulin pens.

Insulin injection site skin issues

The Worldwide Injection Technique Questionnaire survey indicated that the most common complication of insulin injection was lipohypertrophy; this was self-reported by 29.0% of patients and found by physical examination in 30.8% by healthcare providers (Tandon, 2017). Lipohypertrophy is a swelling with a rubbery consistency. While large lipohypertrophy sites can be seen on inspection, others may be evident only on palpation. Blanco et al (2013) found that, out of 64.4% of patients who had lipohypertrophy, 98% either did not rotate sites or rotated incorrectly. Insulin injections can occasionally cause bleeding or bruising. Repeated injections into the same subcutaneous tissue carries risk of infection, abscess formation or scar formation. Scar formation is a consequence of the wound healing process that occurs when body tissues are damaged by a physical injury (Rosique, 2015).

Besides patients, needlestick injuries are also common among healthcare providers. A cross-sectional study found that prevalence of at least one episode of needlestick injury was about 46% (Tandon, 2017). Another study conducted to assess

Box 2. The Indian experience

The Indian results of the recent Injection Technique Questionnaire survey were recently published in *Diabetes Therapy*, March 2017 (Kalra, 2017). The key observations from this survey were as follows:

- Nearly 40% of participants used 4mm and 5mm needle lengths, 8mm needles were used by approximately 16%
- 80% participants reused needles more than three times or more
- Lipohypertrophy was the most common complication of injecting insulin, self-reported by 26% and found by health-care providers in 22% of patients
- Patients with lipohypertrophy had higher HbA1c than in patient without lipohypertrophy. A significantly higher lipohypertrophy was associated with incorrect rotation of sites and with needle reuse
- Patients with lipohypertrophy had high frequency of unexpected hypoglycemia and glucose variability
- Regular injection instructions in the past six months led to proper rotation of injection sites, but limited patients got such instructions
- Most used diabetic sharps ended up in public trash and constituted high risk for needlestick injuries.

prevalence, causes, and prevention of needlestick injuries among nurses found syringe needles and crowded wards as the main causes of needlestick injuries in the south of Iran (Balouchi, 2015).

More locally, there was the work of Kalra et al, (2017) who used a questionnaire survey to examine characteristic of the population and injections techniques in Indian patients. The main findings of this study are reported in *Box 2*.

Errors made by our adult patient

Due to lack of awareness, Ramesh made innumerable errors while using insulin syringes, leading to multiple insulin injection site issues (infection, lipohypertrophy etc) (*Figure 1*). Ramesh mistakenly used the same syringe for days together (multiple injections per day). He did not rotate the injection sites. He did not follow proper hygienic methods while self-administering the injection and he did not report his early lesions to his treating health professional. He possibly missed the diabetes education sessions conducted by his earlier health professionals where they would have highlighted the correct method of insulin administration.

Follow-up

Ramesh made many changes in self-care (including corrections in his insulin administration technique) as advised by the author. His lesions healed and he has continued to improve in overall health overtime (*Figure 2*). In the coming months, the author made further changes in the diabetes management (for example addition of Sodium/glucose cotransporter-2 inhibitors - SGLT2i). With introduction of such medicinal, dietary and lifestyle changes, insulin was completely withdrawn from the therapy for Ramesh. This further added to overall happiness and improvement in quality of life for Ramesh.

Figure 2. Ramesh with his healing lesions, after advise on his injection technique

CONCLUSION

This case highlights that incorrect administration of insulin can result in serious injection site skin complications. Such issues are avoidable by acquiring the correct information and skills needed for proper insulin self-administration using disposable syringes. WAS

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