

Injection Site Complications: Pictures Worth a Thousand Words

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Received: 18-Dec-2025

Accepted: 15-Jan-2026

Published: 01-June-2026

DOI: 10.54646/BeMJ.2026.05

Access: Open Access | CC BY 4.0

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ABSTRACT

Insulin injection site complications remain a critical yet underrecognised barrier to optimal glycaemic control. This pictorial case report presents a series of clinical photographs illustrating common complications encountered in insulin-injecting patients, including lipohypertrophy, lipoatrophy, allergic reactions, infections, and bruising. We highlight current guidelines on injection technique, site rotation, and prevention strategies as recommended by the American Diabetes Association Standards of Care 2026. Regular site assessment and patient education are essential for reducing complications and improving insulin efficacy and long-term diabetes outcomes.

KEYWORDS *Insulin injection; Lipohypertrophy; Lipoatrophy; Injection site complications; Diabetes management; Injection technique*

INTRODUCTION

Insulin, a peptide hormone secreted by pancreatic beta-cells, is indispensable in the management of diabetes mellitus. However, improper injection technique leads to a spectrum of injection site reactions that significantly impair glycaemic control. Despite advances in insulin formulations and delivery devices, injection site complications remain a critical yet frequently overlooked barrier to achieving optimal metabolic outcomes.

With the widespread increase in the prevalence of diabetes and the escalating use of insulin therapy, it is imperative that healthcare professionals recognise, assess, and appropriately address injection site errors. Meticulous attention to injection site health is essential for maximising insulin efficacy, minimising complications, and improving long-term outcomes in individuals with diabetes. This report presents a

pictorial series of skin complications encountered in clinical practice at our centre.

COMMON COMPLICATIONS

Lipohypertrophy is the most frequent insulin injection site complication. It results from poor rotation of injection sites, repeated needle reuse, and administration of cold insulin. The resulting fibrofatty tissue accumulation leads to erratic insulin absorption and unpredictable glycaemic excursions.

Lipoatrophy, now relatively rare with the advent of modern insulin analogues, is characterised by localised loss of subcutaneous fat. It often results from immune-mediated reactions or repeated mechanical trauma to the adipose tissue.

Allergic reactions may present as localised erythema, pruritus, or swelling, typically attributable to insulin itself or its excipients. Infections — manifesting as localised pain,

erythema, warmth, or suppuration — arise secondary to lapses in aseptic technique. Minor complications such as

bruising and petechiae can also occur as a result of needle trauma to superficial vessels.

PICTORIAL ILLUSTRATIONS



Areas of lipohypertrophy due to repeated insulin injection to the same site

Figure 1. *Lipohypertrophy — fibrofatty nodule at injection site due to poor site rotation.*

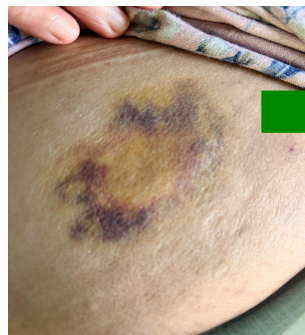


Figure 2. *Lipoatrophy — localised subcutaneous fat loss following repeated injections.*



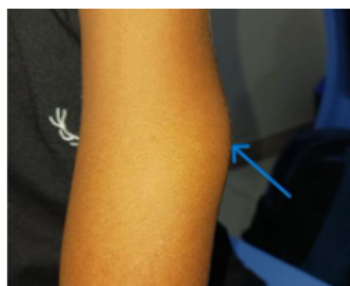
Areas of hyperpigmentation and scarring due to repeated insulin injection to the same site

Figure 3. *Allergic reaction — erythema and induration at the insulin injection site.*

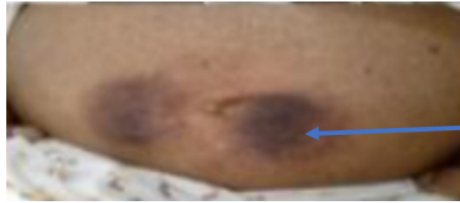


Areas of scarring and hyperpigmentation of the thigh due to repeated insulin injection to the same site

Figure 4. *Bruising — petechiae and ecchymosis from superficial vessel trauma.*



Areas of Lipoatrophy of the arm due to repeated insulin injection to the same site



Areas of lipoatrophy and scarring due to repeated insulin injection to the same site

GUIDELINES AND PREVENTION STRATEGIES

The American Diabetes Association (ADA) Standards of Care 2026¹ emphasise the critical importance of systematic site rotation, meticulous injection hygiene, and routine clinical examination of injection sites at every diabetes review visit.

Patients should be instructed to gently roll the insulin vial between their palms prior to administration. This facilitates warming the medication to room temperature, minimises injection site discomfort, and ensures appropriate homogenisation of insulin suspensions prior to injection.

KEY RECOMMENDATIONS

- ▶ Systematic site rotation within anatomical regions at each injection
- ▶ Use of short 4-mm pen needles (effective even in patients with obesity)⁵
- ▶ New needle for every injection to prevent tissue trauma and infection
- ▶ Ensure subcutaneous delivery — avoid inadvertent intramuscular injection
- ▶ Maintain meticulous injection hygiene to minimise infection risk
- ▶ Warm insulin to room temperature before administration
- ▶ Regular site inspection and patient education at every review

Delayed insulin absorption at sites of lipohypertrophy increases the risk of unpredictable hypoglycaemia. Regular site checks and structured technique training enhance both adherence and clinical outcomes.

CONCLUSION

Insulin injection site errors and associated tissue reactions remain important clinical challenges in diabetes management, despite significant advances in insulin formulations and delivery technology. Systematic regular assessment of injection sites and ongoing, structured patient education are essential for early detection, risk reduction, and timely intervention.

Optimising injection practices — through appropriate site rotation, correct needle length selection, adherence to aseptic technique, and regular clinical review — directly improves insulin efficacy, metabolic control, and quality of life in individuals receiving insulin therapy.

In cases of established lipoatrophy,² injections must be avoided at affected sites. Formulation changes or transition to a different insulin analogue should be considered to prevent immune-mediated tissue damage. Education on systematic rotation and early recognition of complications is vital for prevention.^{3,4}

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How to cite this article: George SP, Joseph M, Santhosh S, Lekshmi SD, John AM. Injection Site Complications: Pictures Worth a Thousand Words. *Believers Medical Journal*. 2025;8(1):pp.17–19. doi: 10.54646/BeMJ.2026.05