Early detection of “insulin balls” using ultrasonography

Diabetes patients often suffer from subcutaneous induration at insulin injection sites during insulin therapy. Among the different types of subcutaneous complications of insulin injection, lipohypertrophy and insulin-derived amyloidosis (IDA) are defined as tumor-like enlargements of adipose tissue and are caused by repeated injections at the same site. Nagase et al. (2009) were the first to report on the condition called the “insulin ball,” which is an IDA with a palpable mass or nodule. Recently, several reports have indicated that IDA is caused by an increase in the administration of insulin at the same site and is associated with poor glycemic control. Therefore, the early detection and prevention of these lesions are important in diabetic patients. However, these lesions are difficult to diagnose because some IDA cases are nonpalpable. IDA can be detected using image inspection (MRI, CT, and ultrasonography), but MRI and CT are probably excessive for observing subcutaneous tissue. By contrast, ultrasonography is a simple, noninvasive, and high-resolution imaging modality and is more suitable for examining subcutaneous induration.

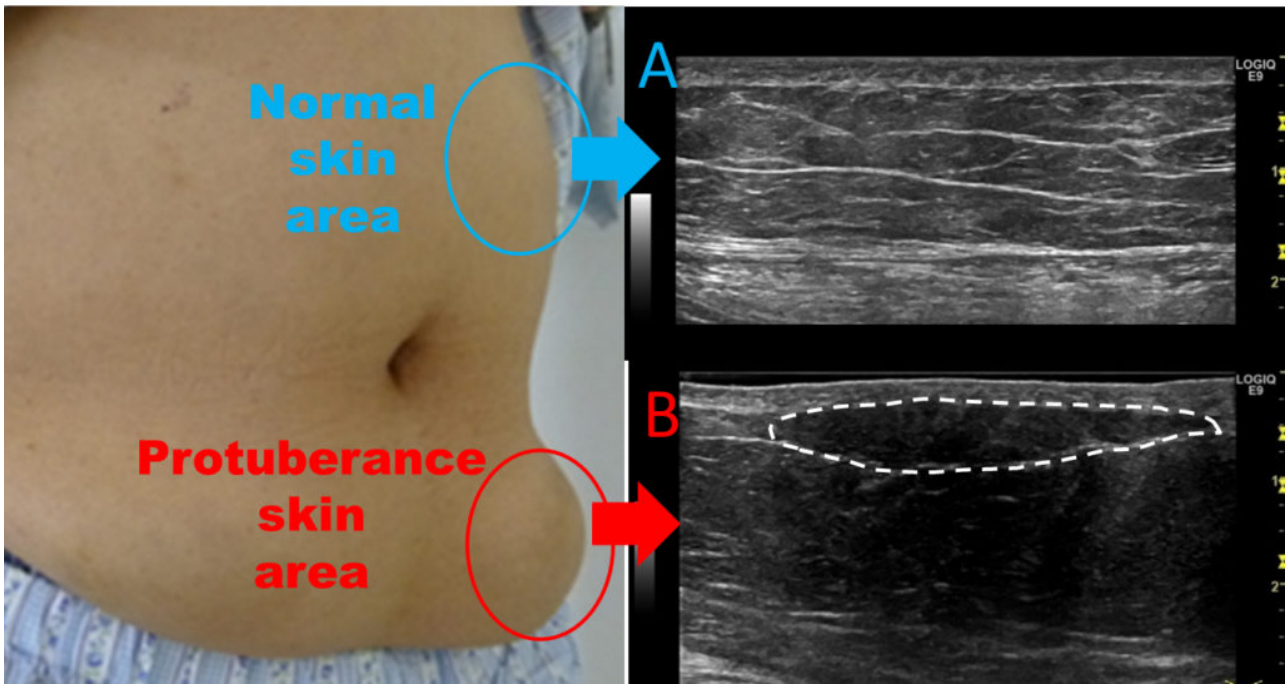

Fig. 1. Ultrasound image of normal and protuberance skin areas on the abdominal wall
The blue and red circles indicate the ultrasound image of normal skin (A) and protuberance skin (B), respectively.
Repeated insulin injections in the same area for a long period of time causes protuberant skin (red circle).
The area in the red circle of the ultrasound image (B) was detected as a black area that is different from the normal skin area (white broken line).

We found 22 subcutaneous amyloidosis lesions by using ultrasonography. Palpation of the site was performed, and 13 and 9 cases were considered palpable and nonpalpable, respectively. The results of this procedure indicated that the presence of subcutaneous lesions will be difficult to determine in obese patients during physical examination. Ultrasonography enables the detailed observation of subcutaneous tissues without being influenced by physical conditions. Considering that amyloid deposits in subcutaneous lesions change the normal dermis and the subcutaneous structure and echogenicity, anomalies can be easily identified by using ultrasonography (Fig. 1).

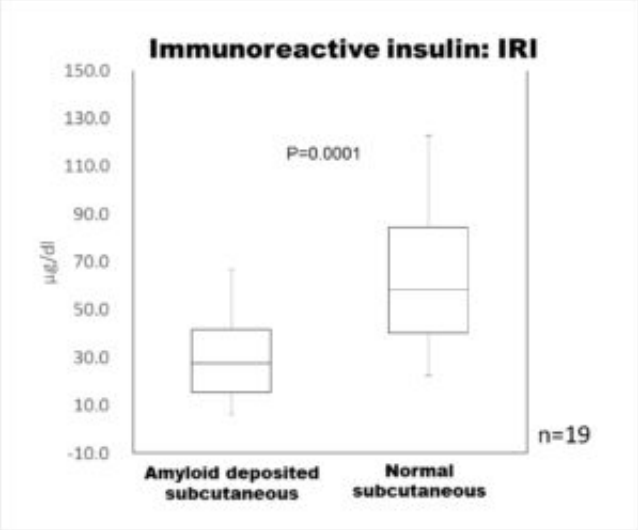

Fig. 2. Absorption of insulin injected into amyloid deposited skin
The administration of insulin in the amyloid deposited skin area led to significantly lower immunoreactive insulin than the administration of insulin in a normal skin area. This finding was due to decreased insulin absorptivity.

Both palpable and nonpalpable types of IDA cause poor glycemic control and increase the required dose of insulin. In our study, the injection site was shift after a subcutaneous lesion was confirmed by ultrasonography. This approach significantly decreased the necessary insulin dose and led to improvements in glycemic control. IDA leads to poor glycemic control because it impairs insulin absorption (Fig. 2). However, the manner in which IDA impairs insulin absorption has not been elucidated. We assumed that poor insulin absorption was related to a reduction in blood flow at the sites of induration. To improve glycemic control in patients undergoing insulin therapy, the accurate identification of injection site induration is important (i.e., ultrasound diagnosis may contribute to better glycemic control in patients undergoing insulin therapy).

We believe that the presence of nonpalpable lesions characterizes the preliminary stage of IDA, whereas the presence of an “insulin ball,” which is palpable, characterizes the advanced stage of

IDA. Therefore, we recommend ultrasonography for detecting nonpalpable IDA.

Ultrasonography should also be used to screen subcutaneous lesions in diabetes patients who are undergoing insulin therapy. We speculate that some diabetes patients may be unaware of abnormalities in their insulin injection sites. The use of ultrasonography in clinical practice can improve diabetes care by enabling the early detection of IDA.

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Publication

Ultrasonography Improves Glycemic Control by Detecting Insulin-Derived Localized Amyloidosis.
Kikuchi M, Hirokawa N, Hagiwara S, Nakayama H, Taneda S, Manda N, Sakata K.
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