

Retained Continuous Glucose Monitor Sensor Wire Fragments Presenting as a Swollen Nodule of the Thigh

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Abstract

A 2-year-old male with genetic-negative, diazoxide-responsive hyperinsulinism presented with a knot in his left, lateral thigh. His hypoglycemia was managed with diazoxide, chlorothiazide, and monitoring via a Dexcom G6 continuous glucose monitor (CGM). X-ray showed 3 metallic wire foreign bodies, consistent with retained Dexcom sensor wires. He was referred to surgery for foreign body removal. Intraoperative fluoroscopy revealed 4 pieces of wire. Two superficial pieces were removed, but 2 small pieces deep to the fascia remained because of significant risk of injury or bleeding if removal was attempted. We present this case to increase awareness in the literature regarding retention of CGM wires. Raised nodules at sites of CGM insertion without fluctuation or erythema and persistent pain should raise suspicion for retention of sensor wires.

Key Words: retained CGM wire, Dexcom G7 sensor, hypoglycemia

Abbreviations: CGM, continuous glucose monitor; HI, hyperinsulinism; US, ultrasound.

Introduction

Since the advent of the first continuous glucose monitor (CGM) devices more than 2 decades ago, technology has continued to advance with newer, smaller, and more accurate CGMs [1]. CGMs have dramatically altered the clinical management of diabetes, improving patient quality of life by minimizing need for fingerstick blood glucose checks, acting within a closed loop with insulin pumps, enabling improved glycemic control, and providing accurate, timely monitoring of glycemic patterns [2–4].

Similarly, CGMs have revolutionized care for patients with hyperinsulinism (HI). Diazoxide is a first-line therapy for treatment of HI and the only medication currently approved for treating HI [5]. Even when adequately treated with diazoxide, patients with HI still require multiple blood glucose checks a day, which historically have been implemented using lancet devices and handheld glucometers. However, CGMs have provided an alternative for blood glucose monitoring with constant measurements of glucose levels and trends. Thus, use of CGMs has been increasing among patients with HI.

Here, we present a 2-year-old male with genetic-negative, diazoxide-responsive HI who presented with a left thigh nodule and was found to have retained CGM sensor wire fragments. Our case highlights the potential of retained wire fragments associated with CGM, adding another case to the few existing cases highlighting various presentations of this issue.

Case Presentation

A 2-year-old male with genetic-negative, diazoxide-responsive HI presented for evaluation of left thigh nodule

over his past CGM site. His HI was managed with standard therapy of diazoxide 45 mg every 8 hours (10 mg/kg/day) and Dexcom G6 sensor and transmitter. He was previously on chlorothiazide to reduce risk of fluid retention associated with diazoxide but weaned off 1 year before his current presentation. His mother changed Dexcom G6 sensors every 10 days and rotated sites between each leg with each new Dexcom sensor insertion. He did not have any reported erythema, swelling, or drainage in his thigh in the past. The nodule appeared several days after his last Dexcom sensor site change. He did not have reported fever or tenderness of the nodule. At the time of his visit, he weighed 12.3 kg (16th percentile for age) with a body mass index in the 5.5th percentile for age.

Diagnostic Assessment

To evaluate the etiology of the nodule, ultrasound (US) was obtained and showed focal nodular hypoechoic area at the left lateral thigh measuring 1.2 cm × 1 cm without identifiable foreign bodies (Fig. 1). Subsequent X-ray of the left femur showed 3 separate metallic foreign bodies consistent with wiring (Fig. 2). The patient was referred to pediatric surgery for evaluation of the foreign body and possible removal. On examination, he was noted to have a 1.5 cm × 1.5 cm non-tender area of induration without erythema or drainage.

Treatment

Given imaging findings of retained foreign bodies, he was taken to the operating room and underwent attempted removal of the wire fragments under general anesthesia. Under live

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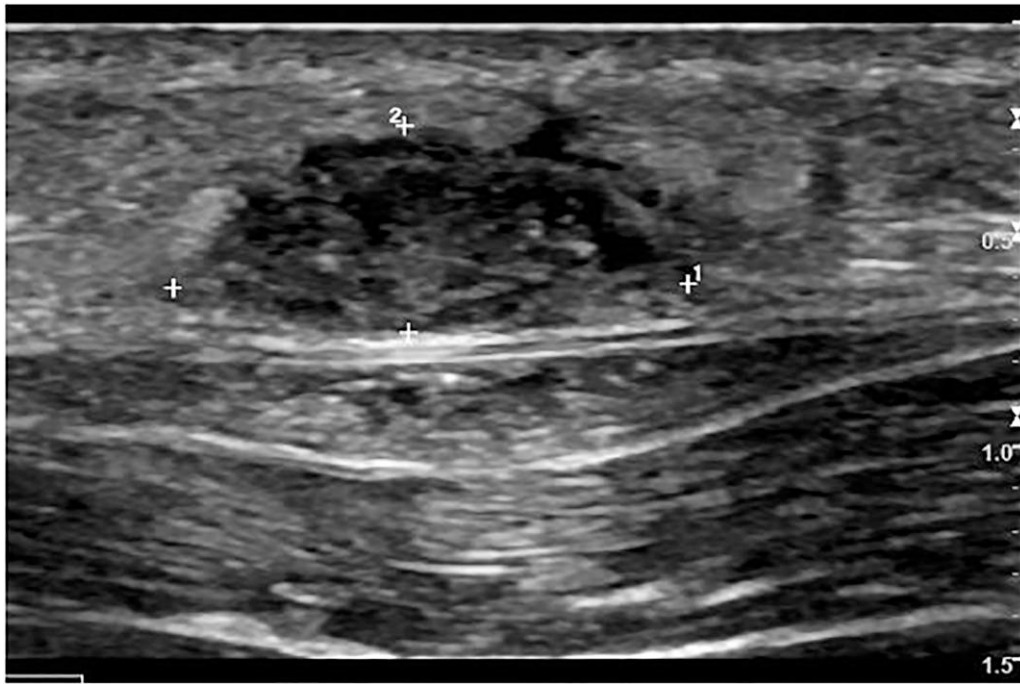


Figure 1. Ultrasound with 1.5 × 1.1 cm subcutaneous nodule. No foreign bodies were identified. Subcutaneous tissue measured 0.7 cm above muscular fascia.



Figure 2. Initial X-ray of left femur suggesting 3 wire fragments.

fluoroscopic X-ray using a C-arm, we identified a total of 4 wire fragments (Fig. 3A). Two fragments were superficial to the muscle fascia and were removed under fluoroscopic guidance. However, 2 fragments were actually deep to the

muscular fascia (Fig. 3B). These were not amenable to removal given that the risk of bleeding and pain with muscular dissection outweighed the benefits of complete removal.

Outcome and Follow-up

After his procedure, he recovered well. Dexcom G6 CGM use was immediately discontinued given his experience with the retained sensor wires, and he was transitioned to monitoring via a handheld glucometer. During this time, his blood glucose values remained stable in the goal range on his diazoxide therapy. After 5 months, he started the Freestyle Libre 3 sensor and has not had further complications to date on this CGM.

Discussion

CGM use has increased over the past several years, particularly with the introduction of closed-loop systems of insulin pumps. The American Diabetes Association recommends offering CGMs for patients on multiple daily injections, basal insulin, or continuous subcutaneous insulin infusion [6]. Particularly, CGMs have shown benefit with improvement in glycemic control and quality of life for patients living with diabetes. Similarly, CGM use for patients with HI provides timely monitoring of glucose levels and eases the burden of manual glucose checks with glucometer.

Our patient presented with a thigh nodule at a prior CGM sensor site and was found to have retained sensor wire fragments requiring surgical removal. Although this is a very rare adverse effect associated with CGM use, several other cases have been reported. A broken Dexcom G6 sensor wire was noted by a patient with type 1 diabetes when changing sensors and led to later presentation with thigh pain because of retained sensor wires visualized on point-of-care US [7]. Furthermore, another patient with type 1 diabetes was

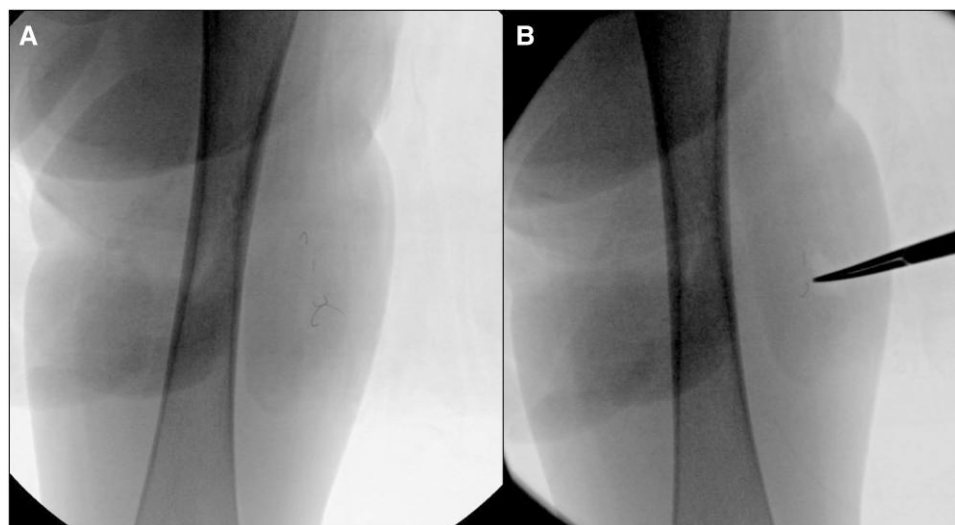


Figure 3. (A) Initial intraoperative fluoroscopy image showing 4 wire fragments. (B) Final fluoroscopy image with the remaining 2 wire fragments deep to the fascia (left of instrument tip).

reported to have a retained CGM sensor wires in the omentum with subsequent migration into the abdominal cavity requiring fluoroscopic-assisted laparoscopic retrieval [8]. The CGM sensors used were noted to have signal loss and then removed, which revealed that the sensor wire had detached [8]. As technology advances, sensor wires have become thinner over time, reducing pain with insertion but also potentially increasing the risk of breaking [9]. Currently, the FreeStyle Libre 3 sensor wires are <0.4 mm in diameter and are inserted to a depth of 5 mm under the skin [10]. Despite theoretical increased risk of breaking with thinner and smaller sensor wires, a recently published review has only noted 2 prior cases of retained CGM sensor wires [9] and another reports 0.03% risk of detached sensor wires in all patients [7], suggesting a lower risk of the complication retained or broken sensor wires.

When considering evaluation for retained CGM sensor wires, X-ray is an optimal, first-line choice. In our patient, US did not identify the retained sensor wires that were subsequently visualized on X-ray. Similarly, X-ray showed retained portions of diabetes devices that were not visualized on US in several other cases [9]. After the retained foreign bodies were identified, surgical removal was recommended based on the foreign body reaction (nodule) and anticipated ongoing use of the CGMs in this patient. The intraoperative identification of wire fragments was challenging because of their small size and required fluoroscopy for 3-dimensional localization. Because of this pediatric patient's lean body mass and limited subcutaneous tissue (measuring 0.7 cm on US of the thigh) portions of the wire likely lodged in the muscular fascia leading to incomplete removal at the time of CGM change. The location of the wire fragments below the muscular fascia also limited surgical removal.

With the increasing number of patients using CGM devices, it is essential to recognize presentations of retained foreign bodies as timely diagnosis and removal can prevent further complications.

Learning Points

- In patients with CGMs, it is essential to carefully evaluate erythema or nodules at the site of CGM insertion

- There is a rare risk of CGM sensor wire retention that requires timely medical attention
- X-ray imaging may be an optimal first-line option for diagnosis of retained CGM wires

Contributors

All authors made individual contributions to authorship. M.K. was involved in the diagnosis and management of the patient. L.D. and M.K. were involved in the preparation and submission of the manuscript. L.G. was involved in the management of the patient and surgical approach in the manuscript submission. All authors reviewed and approved the final draft.

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Disclosures

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Informed Patient Consent for Publication

Signed informed consent obtained directly from the patient's relatives or guardians.

Data Availability Statement

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

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