Retained Glucose Sensor Wire as a Cause of Leg Pain

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Case Presentation

An 18-year-old man with a history of well-controlled type 1 diabetes was referred to the emergency department from a local student health center with several days of leg pain and concern about a possible retained foreign body. His diabetes was managed with an insulin pump interfaced with a Dexcom G6 continuous glucose monitoring (CGM) system. The patient noted that ∼1 week earlier, he was changing his CGM sensor when a small piece of the sensor wire broke and was retained in his right anterior thigh. He was asymptomatic for several days and then noticed some minor throbbing discomfort in the anterior thigh at the site of the retained wire. The pain was exacerbated with prolonged exercise, specifically running, which prompted his presentation.

Exam of the leg was unremarkable. There was no sign of puncture or trauma, a foreign body was not palpable on exam, there was no erythema or swelling, and he was neurovascularly intact. The emergency department physician was able to localize the wire on a point-of-care ultrasound (Figure 1). After discussion with the patient, a shared decision was made to attempt removal of the wire through a small bedside incision. Despite the localization and use of a finder needle, the physician was unable to conclusively identify the foreign body in situ and was unable to remove it.

A femur radiograph was then obtained, which radiographically demonstrated the foreign body (Figure 2). Orthopedic surgery was consulted, and they attempted removal with real-time fluoroscopy, which unfortunately was also unsuccessful. General surgery was then consulted for the possibility of a larger incision and dissection for removal. After discussion with general surgery and the patient, there was consensus that a large incision and operative exploration would have a longer healing time and pose a higher risk of complications than leaving the sensor wire in place.

The patient was discharged from the emergency department with follow-up arranged with general surgery should he have progression of symptoms. The patient was advised to monitor for complications, specifically infection. To date, the patient has not followed up within the regional network system, and his clinical status is unknown.

Questions

1. What is the incidence of a retained sensor wire from CGM?
2. What are potential complications and what is the optimal management of a retained sensor wire?

Commentary

CGM is rapidly becoming the standard of care for patients with type 1 diabetes, particularly those treated with insulin pump therapy (1). Available from a variety of manufacturers, real-time and intermittently scanned CGM systems are reliable and well-tolerated and have allowed many patients with diabetes to be more independent and achieve better, more nuanced glycemic control.

As with any new technology, there are risks of adverse effects. Based on literature review, to date, cutaneous complications appear to occur at a rate of one event per 8 weeks' wear time (2). In one case, a sensor wire fractured in a lean child after placement of a sensor in the abdominal wall, and a similar wire fractured in the replacement sensor. The first wire was removed from the abdominal wall, whereas the second migrated to

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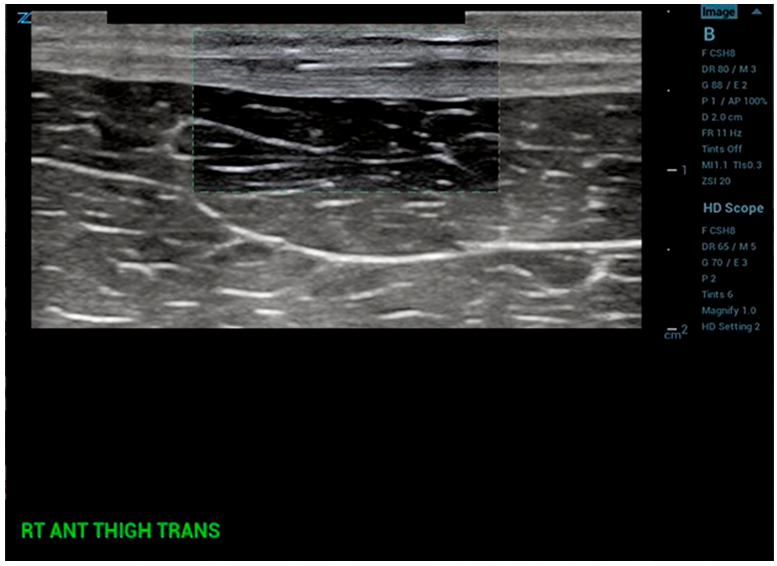

FIGURE 1 Point-of-care ultrasound of the right anterior thigh demonstrating a foreign body in transverse view.

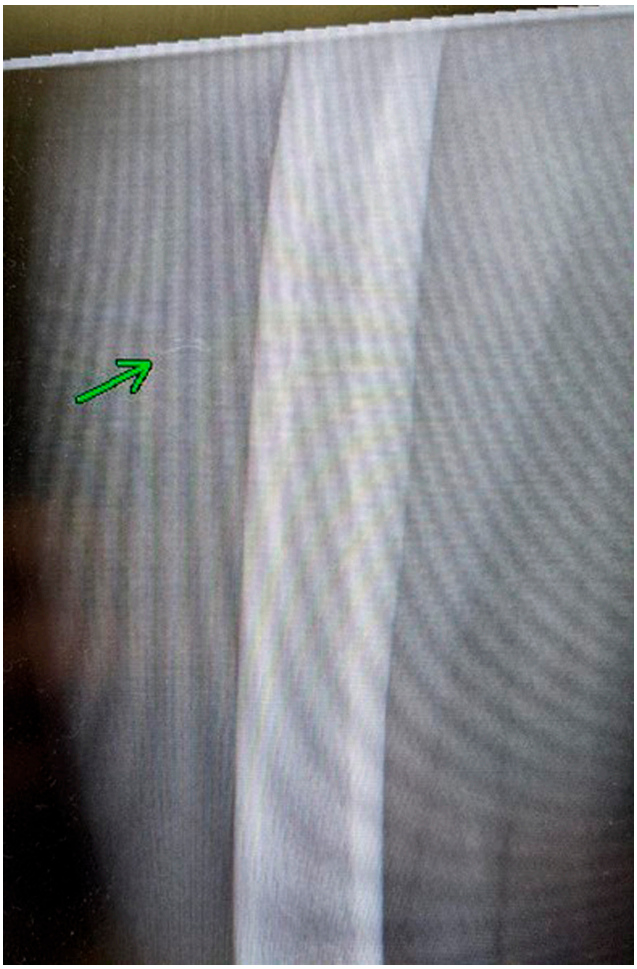

FIGURE 2 Femur radiograph demonstrating the retained sensor wire.

the omentum, where it was located with intraoperative laparoscopy and removed with electrocautery (3).

Shrapnel injuries in soft tissues often do not require operative treatment, and although late migration has been reported, it is rare (4). It is perhaps not surprising that extracting the wire was unsuccessful. Sensor wires are flexible, so any applied force would be likely to deform the wire rather than allow its extraction. For these reasons, wire removal is not usually necessary.

At the time of our initial evaluation of this patient, we were unaware of other case reports of sensor wire breakage. We have since learned of a report that was presented in abstract form at the American Diabetes Association's 71st Scientific Sessions in 2011, confirming that broken and retained sensor wires were a rare occurrence with CGM use, involving about 0.03% of patients. Most patients who experienced broken wires did not have significant sequalae, and current recommendations call for medical attention only if there are signs of infection or inflammation (5).

More recent data have confirmed that the rate of broken or detached sensor wires has remained very low and essentially unchanged over the years, and there do not appear to be any sequelae from these retained wires. In addition, Dexcom has performed MRI testing and confirmed that there is no significant heating or migration of broken sensor wires during MRI scans (D. Price, personal communication).

For a broader picture, we downloaded text files from the U.S. Food and Drug Administration website (6), constructed a database of CGM adverse events for the years 2019–2020, and queried the text description of the adverse events for the word "detached." Of the 373,500 adverse events, the term "detached" occurred in 2,822 (0.08%). Although we did not examine all records, the ones we did examine showed that the word detached referred to the sensor wire and occurred across most manufacturers.

Although broken sensor wires confined to the subcutaneous tissue might be a nuisance, they are benign and likely to be static. On the other hand, those that migrate into the peritoneum, as in a smaller and thinner child, might be more problematic. It is reassuring that this appears to be a singularly rare event, but we urge our colleagues to be vigilant regarding this possibility and to educate patients and their caregivers about this rare but potentially serious occurrence.

Clinical Pearls

- CGM has advanced to the forefront of contemporary type 1 diabetes management. It is effective and reliable, and valuable in mitigating risks of hypo- and hyperglycemia.
- Although the safety of CGM is unquestioned, occasionally, a CGM sensor wire breaks and can cause local or distant injury.
- Although the U.S. Food and Drug Administration and CGM system manufacturers have considerable data on this type of event, it is not clear how widely appreciated the problem of sensor wire breakage is in the general diabetes care community.

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DUALITY OF INTEREST

No potential conflicts of interest relevant to this article were reported.

AUTHOR CONTRIBUTIONS

All authors contributed the literature review and the writing and revision of the manuscript. J.J.R. evaluated the patient. The authors are jointly guarantors of this work and, as such, had full access to all the data in the case and take responsibility for the integrity of the data and the accuracy of the care presentation.

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