Insulin pump exposed to radioactive iodine.

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CASE REPORT

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Insulin pump exposed to radioactive iodine

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Key Clinical Message

Insulin pumps are not typically assessed for malfunction after exposure to significant radiation. We assessed an insulin pump kept for 48 hours on a patient on hemodialysis who required radioactive iodine ablation treatment for thyroid cancer. On download inspection, the pump showed normal function.

KEYWORDS

ablation, insulin pump, malfunction, radiation, radioactive exposure, radioactive iodine, thyroid cancer

1 | BACKGROUND

Insulin pump manufacturers state in user guides that pumps should not be exposed to certain medical procedures and equipment, including X-ray, MRI, and radiation treatment, to avoid damage to the insulin delivery system. Specifically, the user guide for the Animas® One Touch® Ping® advises pump users to "disconnect pump prior to radiation treatment and leave pump in locked dressing room".[1] However, the research on insulin pump exposure to radiation is lacking: After a thorough review of multiple scholarly databases including Medline and CINAHL, the closest related research studies involve intrathecal infusion pumps, implantable cardioverter defibrillators, and pacemakers with minimal proven research involving the effects of radiation on these devices. Therefore, an untouched area of clinically relevant research has been identified involving the exposure of insulin pumps to radiation to determine the effects.

2 | CLINICAL CASE REPORT

A 50-year-old male with medical history of non-insulin dependent diabetes mellitus, hepatitis C, and end-stage renal disease from polycystic kidney disease status post bilateral nephrectomies was diagnosed with thyroid cancer at our health network. The patient underwent a total thyroidectomy with central and left neck dissection surgery and pathology revealed multifocal, bilateral classical papillary thyroid cancer with positive margins and extension to neck lymph nodes, classified as pT3 pN1. He was started on levothyroxine and scheduled for thyrotropin alfa-stimulated radioactive iodine (RAI) ablation. Due to the patient being anephric on hemodialysis and requiring radioactive iodine for his thyroid cancer, he was in a unique circumstance of prolonged retention of radioiodine; at least until undergoing his first post-administration hemodialysis. After consultation with our network's Institutional Review Board and discussion of the risks and benefits with the patient, he voluntarily agreed to keep a running insulin pump on his person to assess for malfunction secondary to radioactive exposure, as this has never been assessed.

Animas® (Animas Corporation, West Chester, PA) donated a OneTouch® Ping® insulin pump for this study. The pump was set up to mimic normal daily use. It was filled with 189 units of saline. The tubing was shortened with open end in absorptive gauze and primed with 8 units. Minimal basal rates were set as follows for total of 0.68 units of basal/24 hours: 12 AM 0.025, 3 AM 0.05, 6 AM 0.025. A carbohydrate ratio was set at 15, sensitivity at 50. Target blood sugars were set at 120 ± 10 mg/dL. Active insulin time was set at 4 hours. The patient obtained the pump prior to his

radioactive iodine dosing. The insulin pump was placed in a sealed plastic sandwich bag and was not physically attached to the patient. The patient carried it in his clothing, close to his body, for 48 hours.

The patient received thyrotropin alfa (0.9 mg) intramuscularly on days 1 and 2. He received 1.6 mCi of I^{123} following the second thyrotropin alfa injection for pre-treatment imaging and radioiodine uptake. Delayed 24 hours anterior and posterior whole-body and regional neck planar images were obtained with calculation of 24-hour radioiodine uptake of the neck. Dosimetry was not performed due to poor renal function on hemodialysis. He received a therapeutic dose of 46.5 mCi of I^{131} for RAI ablation. The patient underwent hemodialysis at our network's hemodialysis center at 24 and 48 hours following RAI ablation.

3 | RESULTS

The calculated 24-hour radioiodine uptake of the neck was 1.7%. In addition, SPECT/CT images of the neck were obtained and the patient had the insulin pump on his person during imaging.

A dosimeter was attached to the insulin pump that he carried with him from the time of RAI treatment. The dosimeter report showed that the insulin pump received a total radiation exposure of 1483 mrem. For reference, an average person receives background radiation exposure of 311 mrem per year from natural sources.[2] Furthermore, a single chest x-ray results in 2-4 mrem of radiation.[3] The patient did not report any alarms or error messages associated with the insulin pump. The insulin pump was inspected on day 2 following the radioactive iodine administration, the pump screen function and button pushing were grossly normal.

The network Radiation Safety Officer (RSO) utilized a Geiger-Mueller pancake probe to evaluate the pump for evidence of gross contamination. Wipe test samples from the insulin pump were then taken and evaluated to check for removable radioactive contamination on the pump surface. After this 15-minute safety clearance process, the RSO deemed it safe to download and review the insulin pump. Volumes of basal insulin rates were as expected based on pump settings and consistent on a daily basis. There were no abnormal boluses or suspends. The pump reservoir was changed on day 3. Repeat pump download performed one week later showed no signs of abnormal pump function, and delivery of basal saline was appropriate.

4 | DISCUSSION

This is the first known case of monitoring an insulin pump being purposefully exposed to radiation. Due to this patient's situation, anephric on hemodialysis and requiring radioactive iodine for his thyroid cancer, he was in a unique circumstance to expose an insulin pump to significant radiation exposure. After 48 hours of continuous radiation exposure, equating to the amount of radiation that an average person receives over more than 4 years, the Animas® insulin pump on the patient did not experience any malfunctions, alarms, battery power loss, or cause any harm to the patient. This case report shows an overwhelmingly benign result of significant radiation exposure to an insulin pump.

Exposing insulin pumps to radiation of any type is not recommended based on manufacturer guidelines. The basis of this recommendation is a presumed precaution. The Food and Drug Administration indicates that a small number of adverse events during CT imaging have been reported though direct causation has not been confirmed.[4] Adverse events have included hypoglycemia, hyperglycemia, seizures, loss of consciousness, or ketoacidosis. However, when compared to the number of insulin pumps exposed to CT radiation without reported adverse events, the numbers of reported events are small.[4]

This article demonstrates only one type of insulin pump in one radioactive exposure situation and by no means should supersede current standards of care. Larger, multicenter research studies need to be completed to validate the safety and function of insulin pumps after radiation exposure, particularly for patients receiving radioactive materials for diagnostic or therapeutic purposes. Clinically, this research will benefit patients by allowing them to continue utilizing their insulin pumps during radiation exposure; preventing the myriad of complications that can occur when insulin pumps are removed.

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CONFLICT OF INTEREST

None declared.

AUTHOR CONTRIBUTIONS

ALM, SCK, and GAP: contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript. KMC: helped with the acquisition of data and contributed to manuscript data, edits, and review.

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REFERENCES

1. Animas Corporation. Owner's booklet: OneTouch® Ping® insulin pump. Warnings and precautions: radiology equipment, 2014;5-8. https://www.animas.com/sites/animas.com/files/pdf/41029400B_OB_OTP_US_EN_MGDL_R3.pdf. Accessed July 11, 2018.
2. US Environmental Protection Agency. Radiation protection: radiation sources and doses, 2017. https://www.epa.gov/radiation/radiation-sources-and-doses. Accessed July 11, 2018.
3. Health Physics Society: Specialist in Radiation Safety. Radiation exposure from medical diagnostic imaging procedures. Health Physics Society Fact Sheet, 2006:1-3.
4. US Food and Drug Administration. Electromagnetic compatibility – interference between CT and electronic medical devices, 2018. https://www.fda.gov/Radiation-EmittingProducts/RadiationSafety/ElectromagneticCompatibilityEMC/ucm489704.htm. Accessed July 11, 2018.

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