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Use of diabetes technology in radiation-related settings

Diabetes management has undergone significant technological advances in recent years. Both patients and healthcare professionals now have access to more precise, convenient, and safer devices. Among the most relevant developments are insulin pumps and continuous glucose monitoring (CGM) systems, which facilitate more stable and effective disease control, reduce the risk of complications, and improve the quality of life of people living with diabetes.

The advent of individualized and precision medicine has been accompanied by a significant increase in the use of radiological examinations such as magnetic resonance imaging (MRI), computed tomography (CT), PET-CT, ultrasound, and plain radiography. These imaging modalities are used both for diagnosis and disease follow-up and have therefore become routine tools in clinical practice.

Patients using diabetes management devices and healthcare professionals who request or perform imaging modalities must be aware of the potential risks and limitations associated with these procedures.

RECOMMENDATIONS ACCORDING TO THE TYPE OF RADIOLOGICAL EXAMINATION

Plain Radiography (X-ray) and Bone Densitometry (DEXA)

Plain radiography is a rapid imaging test that uses X-rays to obtain information about different parts of the body, such as bones or the chest. Bone densitometry (DEXA) is a type of X-ray examination used to measure bone mineral density.

- **Compatibility:** X-ray imaging generally does not affect insulin pumps or glucose sensors.
- **Recommendations:** Removal of the device is not required, although it is preferable to avoid direct exposure of the device to the X-ray beam.

Ultrasound

Ultrasound is an imaging modality that uses ultrasonic waves transmitted through a transducer placed on the patient's skin. It is commonly used to evaluate abdominal organs, the heart, and for obstetric diagnosis and follow-up during pregnancy. During the examination, ultrasound gel is applied to the skin to eliminate air between the transducer and the skin surface, allowing better transmission of ultrasound waves and clearer image acquisition. It is a painless and safe procedure that does not involve ionizing radiation.

- **Compatibility:** Ultrasound does not interfere with insulin pumps or glucose sensors.

- **Recommendations:** Devices do not need to be removed. Healthcare personnel should be informed to avoid applying pressure or ultrasound gel over the area where the sensor or pump is located, as this may cause detachment and affect glucose reading accuracy.

COMPUTED TOMOGRAPHY (CT)

CT is a radiological test that uses X-rays to obtain detailed images of the interior of the body. Unlike plain radiography, which produces a single image, CT acquires multiple images from different angles that are processed by a computer to generate cross-sectional images of the studied area. As a result, radiation exposure is considerably higher.

In some cases, intravenous or oral contrast agents are administered to enhance visualization of specific anatomical structures. The examination is rapid, painless, and widely used to evaluate multiple diseases.

- **Compatibility:** CT generally does not damage or alter the functioning of insulin pumps or glucose sensors.
- **Recommendations:** Some manufacturers recommend removing devices if they are located directly within the imaging field, as they may produce artifacts (shadows or distortions) that hinder image interpretation.

Magnetic Resonance Imaging (MRI)

MRI is an advanced imaging modality that provides high-resolution images of internal body structures. Unlike radiography or CT, MRI does not use X-rays but instead relies on a powerful magnetic field and radiofrequency waves. MRI examinations are relatively long, typically lasting 15–45 minutes, depending on the anatomical region studied. Although painless, some patients may feel discomfort due to loud noise or confinement within the scanner. In certain cases, IV contrast is administered to improve image quality.

- **Compatibility:** In general, insulin pumps and glucose sensors are not compatible with MRI. The strong magnetic field may damage these devices, reprogram them, or attract them if they contain metallic components. Additionally, radiofrequen- >

PATIENTS USING DEVICES FOR DIABETES MANAGEMENT AND HEALTH CARE PROFESSIONALS WHO ORDER OR PERFORM DIAGNOSTIC IMAGING MODALITIES MUST BE AWARE OF THE RISKS AND LIMITATIONS ASSOCIATED WITH IMAGING PROCEDURES



- cy waves may heat metallic parts, potentially damaging the device, causing skin discomfort, altering electronic function, and interfering with data transmission from the sensor. Therefore, in most cases, both the pump and sensor must be removed before entering the MRI suite. Reviewing the device's technical specifications is essential, as some models are approved as MRI-compatible.

- Recommendations:

- Patients must inform the radiology team if they use an insulin pump or glucose sensor.
- Remove all devices before the examination and store them outside

BET CT

PET-CT combines two imaging modalities in a single examination. Positron

the MRI room unless the manufacturer and medical team confirm MRI safety for the specific model. Metallic cannulas (e.g., steel cannulas) should be removed too.

- After the examination, reapply the insulin pump and a new glucose sensor according to standard instructions and verify proper functioning.
- Always consult the manufacturer's technical documentation, as newer devices may have specific compatibility conditions.

emission tomography (PET) involves the administration of a radioactive substance (radiopharmaceutical or radiotracer), typically labeled glucose, which accumulates in tissues with high metabolic activity such as tumors or inflammatory areas. CT provides detailed anatomical information using X-rays. The combination allows simultaneous acquisition of functional/metabolic and anatomical data, increasing diagnostic accuracy.

- **Compatibility:** Insulin pumps and glucose sensors do not have specific contraindications for PET-CT. However, devices located within the imaging field may cause artifacts that interfere with image interpretation. In addition, prolonged fasting and radiotracer administration may in-

Imaging modality	Compatibility	Recommendations
X-ray/ DEXA	Safe	Avoid direct exposure of the device to the radiation beam.
Ultrasound	Safe	Avoid pressure or gel over the sensor or pump.
CT scan	Safe (except for possible artefacts)	Remove the device if it is located within the area being examined.
MRI	Generally not compatible	Always remove unless the model is "MRI-safe"; consult the manufacturer.
PET-CT	Safe, possible artefacts	Fast for 4–6 hours; blood glucose <160–180 mg/dL; do not administer insulin for 4 hours before radiotracer injection.

TABLE 1. Compatibility and recommendations for the management of glucose monitoring devices and insulin pumps during major radiological examinations

» Fluence glucose readings. Healthcare personnel will advise whether the device should be removed or positioned outside the imaging field.

- **Recommendations:**

- Follow health care personnel instructions carefully.
- Fast for at least 4–6 hours before PET-CT to ensure controlled glucose levels and avoid interference with radiotracer uptake.
- Blood glucose should ideally be < 160–180 mg/dL at the time of radiotracer injection; the final decision to proceed will be individualized by the Nuclear Medicine team.
- Avoid insulin administration via pump during the 4 hours prior to radiotracer injection, as pre-study insulin may increase uptake in various organs and alter result interpretation.

SAFETY OF DIABETES DEVICES AT AIRPORTS

During airport security screening, the safety of insulin pumps and continuous glucose monitoring systems is a relevant concern. Although some manufacturers allow their devices to pass through metal detectors, exposure to X-ray machines—both baggage scanners and full-body scanners—is strongly discouraged due to the potential risk of radiation-induced malfunction. Patients are therefore advised to request manual inspection of their devices, avoid exposure whenever possible, and carry a medical certificate supporting these recommendations to facilitate the security process. **D**

CONCLUSIONS

In recent years, innovation in insulin pumps and glucose sensors has represented a major advance in diabetes management, offering increased safety and improved quality of life. However, the coexistence of these devices with radiological examinations requires a thorough understanding of their compatibility and limitations. X-ray imaging and ultrasound are considered safe, whereas CT and PET-CT may generate artifacts, and MRI is generally incompatible except for specific approved models. Education, prevention, and communication between patients and healthcare professionals are essential to ensure accurate diagnoses and patient safety throughout the entire process.

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