

To Revolutionize Opioid Overdose Response New Implantable Device Found

A recent study used a swine model to demonstrate the potential of an implantable system for [opioid safety](#) (iSOS).



Study

The current study introduced the iSOS (measuring 8 × 12 × 78 mm), which functions as a subcutaneously (s.c.) implantable robotic first responder. This device contains multiple sensor modalities that detect opioid overdose in real-time by monitoring cardiorespiratory signals and identifying unique physiological [biomarkers](#) that are specific to an overdose event.

Furthermore, in an opioid overdose condition, the system is programmed to set off a medical alert system featuring auditory and [tactile signals](#) while sending alerts to the user's smartphone. This system is also equipped to deliver naloxone at an ultra-fast speed.

The newly designed system is composed of four compartments designed for [precise functions](#).

The first compartment contains a flexible drug reservoir made of polyurethane that contains 10 mg of naloxone, an actuator comprising two check valves and a rotational-to-linear (R2L) converter, and a direct current (DC)-brushed geared motor for rapid [naloxone delivery](#).

The iSOS reservoir also contains a port to allow for percutaneous drug refilling. The second compartment contains the multi-sensor array that monitors heart rate (HR), respiratory rate (RR), HR variability (HRV), body temperature, and [blood oxygen saturation](#) (SpO₂).

The third compartment houses wireless charging and an onboard power supply, and the last compartment is dedicated to the [medical alert system](#).

The device's performance was assessed through in vitro and in vivo analysis. For in vivo assessment, a female Yorkshire swine was used to test the efficacy of the iSOS in detecting [fentanyl overdose](#) and aiding in recovery via naloxone administration.

For the pharmacokinetic study, the study pigs were divided into two groups. The first group was treated with s.c. injections of naloxone (Inj-Naloxone), and the animals of the second group with the [naloxone-loaded device](#) (Device-Naloxone) implantation received 10 mg of naloxone. Blood samples were collected for analysis.

Study Result

The new implantable device was found to accurately detect physiologic changes linked with opioid overdose and facilitate effective naloxone administration. The implantation site was selected for the s.c. space because it reduced mechanical irritation after [implantation](#).

The implanted device lasts up to 16 days, and naloxone remains stable at [body temperature](#) for over two weeks. Although the implantable device is large, it facilitates data collection that aids in closed-loop decision-making for opioid overdose management.

The swine model demonstrated that the iSOS implant was able to detect both rapid opioid overdose with apnea and gradual opioid poisoning with [hypopnea](#). For both instances, naloxone was effectively administered.

Conceptually, this device can be easily implanted in patients who are at a higher risk of an opioid overdose at a clinic through local [anesthesia](#). At subsequent follow-up visits, the device can be wirelessly recharged, and the naloxone reservoir replenished, if required.

The loop recorders could enable continuous monitoring of [heart activity](#) for over three years without requiring recharging. This exceptional power management can be attributed to the single chip using system-on-chip (SoC) technology.

The [ECG chip](#) could independently calculate the R-R interval at a sampling frequency of 512 Hz, consuming an average current of only 135 μ A.

Conclusion

The new iSOS device exhibited the potential to prevent fatal opioid overdose, which could benefit patients and [healthcare](#) providers.

The device's efficiency can be improved by further optimizing [power consumption](#) and new naloxone formulations, which could enable prolonged monitoring, storage stability, and efficacy.

Source:

<https://www.news-medical.net/news/20240819/New-implantable-device-could-revolutionize-opioid-overdose-response.aspx>