World first: researchers develop completely automated anesthesia system

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Researchers at McGill University and the McGill University Health Centre (MUHC) have performed the world's first totally automated administration of an anesthetic. Nicknamed "McSleepy," the new system developed by the researchers administers drugs for general anesthesia and monitors their separate effects completely automatically, with no manual intervention.

"We have been working on closed-loop systems, where drugs are administered, their effects continuously monitored, and the doses are adjusted accordingly, for the last 5 years," said Dr. Thomas M. Hemmerling of McGill's Department of Anesthesia and the Montreal General Hospital, who heads ITAG (Intelligent Technology in Anesthesia research group), a team of anesthesiologists, biomedical scientists and engineers. "Think of "McSleepy" as a sort of humanoid anesthesiologist that thinks like an anesthesiologist, analyses biological information and constantly adapts its own behavior, even recognizing monitoring malfunction."

The anesthetic technique was used on a patient who underwent a partial nephrectomy, a procedure that removes a kidney tumor while leaving the non-cancerous part of the kidney intact, over a period of 3 hours and 30 minutes. To manipulate the various components of general anesthesia, the automated system measures three separate parameters displayed on a new Integrated monitor of anesthesia (IMA): depth of hypnosis via EEG analysis, pain via a new pain score, called Analgoscore, and muscle relaxation via phonomyography, all developed by ITAG.

The system then administers the appropriate drugs using conventional infusion pumps, controlled by a laptop computer on which "McSleepy" is installed. Using these three separate parameters and complex algorithms, the automated system calculates faster and more precisely than a human can the appropriate drug doses for any given moment of anesthesia. "McSleepy" assists the anesthesiologist in the same way an automatic transmission assists people when driving.

As such, anesthesiologists can focus more on other aspects of direct patient care. An additional feature is that the system can communicate with personal digital assistants (PDAs), making distant monitoring and anesthetic control possible. In addition, this technology can be easily incorporated into modern medical teaching programs such as simulation centers and web-based learning platforms.

Anesthesia care is characterized by many biological and pharmacological parameters to monitor record and analyze. "It will probably take two years to perfect the system," Dr. Hemmerling said. "Many people are reluctant to rely on automated systems, especially when they are not visible – it is not clear what they are actually doing or how - , the fear of a 'black box' which suddenly takes over". In designing "McSleepy", we put in considerable research on the design of an interface which is clear, easy to read, resembles displays of our everyday practice but still provides a detailed clinical picture of what is going on and what has happened.

Dr. Hemmerling hopes that a commercial system might be available within the next 5 years.

Source: McGill University