

Innovative mechanical system makes it easy to turn bedridden patients

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The metal clamp that held the two sheets. Credit: Alain Herzog

It takes around five or six people and a considerable amount of effort to turn an intubated patient in a hospital bed. For patients in an artificial coma, this procedure is performed at least twice a day in order to

improve patients' breathing and prevent bedsores. And now that intensive care units are filling up as a result of the pandemic, the problem is getting worse. A team comprising scientific assistants and a student, headed by Prof. Charles Baur at EPFL's Instant-Lab in Neuchâtel, have developed a simple system that allows just three people to turn a patient with little effort. It was tested by doctors and nurses at the La Source Clinic simulated hospital in Lausanne and the Geneva University Hospital (HUG) intensive care unit, and everyone involved was enthusiastic about the new device. It has been patented and is now ready for large-scale production.

Turning patients gently without straining medical staff

Staff members currently turn patients by first placing a clean sheet on the patient so that the bedsheets can be changed at the same time, then gently rolling the patient over using the strength of their arms. With the Instant-Lab system, the top and bottom sheets around the patient are bound together in four places—by each shoulder and each knee—using a kind of metal clamp. In these clamps, the two sheets of fabric are rolled around a tiny rod that fits into a cavity in order to secure the sheets. The result is that the patient is held firmly between the two sheets. The metal clamps also contain holes for attaching cables; cables are introduced into the holes on one side of the patient's body and attached to a patient lift—the machine typically used in hospitals to transfer patients. The patient lift gently raises the sheets and with them, one side of the patient, so that the patient ends up in a lateral position. Then the patient is gently placed on his back or his stomach, depending on whether they were initially in a prone or supine position. Very little effort is required from the hospital staff during this procedure.

Focusing on the right turning technique

The existing procedure for turning patients can be tricky, so teams of

staff members tend to work together for as long as possible so they learn to coordinate smoothly and minimize the risks. The procedure also entails a considerable amount of lifting, which can often lead to fatigue, muscle pain and injury among staff members. But with the Instant-Lab system, just three nurses or nurse's aides are needed and they don't have to lift a patient's full weight. "The system is very gentle and lets the caregivers focus entirely on performing the right turning technique," says Dominique Truchot-Cardot, the doctor who heads SILAB, the innovation unit at the La Source simulated hospital. Two staff members prepare the metal clamps and make sure the patient, their tubes and any other medical cables are positioned correctly. The third person operates the patient lift, either manually or electronically, so that the patient is turned over gradually.

A small, highly motivated project team

The research project was started in October alongside Instant-Lab's regular activities. The goal was to develop a fully operational system quickly, in the midst of the pandemic. The five people on the project team, led by Baur, are all experts in microengineering and worked extremely hard—largely during their free time—to fine-tune their device, called Décubitus. It was designed to fit in with existing hospital procedures and to not require any special training. During the initial December tests on dummies at the La Source simulated [hospital](#), doctors and nurses agreed that the system was easy to use and would be very useful at hospitals. The team received the same feedback during the tests carried out more recently at HUG.

Ready for mass production

Décubitus has been patented by EPFL's Technology Transfer Office (TTO) and its parts are ready to be manufactured on a large scale. The parts' simple shape means they can be produced at a lower cost. The

initial Décubitus prototypes were funded by Enable, an EPFL program designed to facilitate technology transfer to market. The project team now needs to raise funding for the production phase. "Our system proved highly popular with the [hospital staff](#) who tried it out, and we want to move fast with the rollout," says Baur. "Our hope is that it can soon become part of hospitals' routines and ease the burden on caregivers." Creating a startup and raising funds would take too long, but the project team made a commitment when they came up with the idea to see it all the way through. They are therefore redoubling their efforts to find manufacturers to work with and complete all preliminary administrative requirements as soon as they can.

Provided by Ecole Polytechnique Federale de Lausanne

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