

ABSTRACT

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Cranial sonolucent prosthesis: a window of opportunity for neuro-oncology (and neuro-surgery).

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INTRODUCTION: Ultrasound (US) is a versatile technology, able to provide a real-time and multiparametric intraoperative imaging, and a promising way to treat neuro-oncological patients outside the operating room. Anyhow, its potential is limited both in imaging and therapeutic purposes by the existence of the bone shielding. To enhance the spectrum of uses, our group has designed a dedicated US-translucent cranial prosthesis. Herein, we provide the proof of concept of a long-term US-based follow-up and a potential bedside therapeutic exploitation of US.

METHODS: The prosthesis was first implanted in a cadaveric specimen to record any issue related to the cranioplasty procedure. Hence, the device was implanted in a patient undergoing surgery for a multi-recurrent anaplastic oligodendroglioma. US multiparametric scans through the device were acquired at 3, 6, 9, and 30 months after the procedure.

RESULTS: The prosthesis could be modeled and implanted through ordinary instruments, with no concerns over safety and feasibility. Trans-prosthesis multiparametric US imaging was feasible, with image quality comparable to intraoperative US. Long-term follow-up in an outpatient setting was possible with no adverse events. Trans-prosthesis mechanical interaction with microbubbles was also feasible during follow-up.

CONCLUSIONS: This report provides the first proof of concept for a potential breakthrough in the management of neuro-oncological patients. Indeed, through the implantation of an artificial acoustic window, the road is set to employ US both for a more dynamic long-term follow-up, and for US-guided therapeutic applications.

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