

Vision of the future: initial experience with intraoperative real-time high-resolution dynamic infrared imaging. Technical note.

Ecker RD, Goerss SJ, Meyer FB, Cohen-Gadol AA, Britton JW, Levine JA. Department of Neurological Surgery, Mayo Clinic and Foundation, Rochester, Minnesota, USA.

High-resolution dynamic infrared (DIR) imaging provides intraoperative real-time physiological, anatomical, and pathological information; however, DIR imaging has rarely been used in neurosurgical patients. The authors report on their initial experience with intraoperative DIR imaging in 30 such patients. A novel, long-wave (8-10 micron), narrow-band, focal-plane-array infrared photodetector was incorporated into a camera system with a temperature resolution of 0.006 degrees C, providing 65,000 pixels/frame at a data acquisition rate of 200 frames/second. Intraoperative imaging of patients was performed before and after surgery. Infrared data were subsequently analyzed by examining absolute differences in cortical temperatures, changes in temperature over time, and infrared intensities at varying physiological frequencies. Dynamic infrared imaging was applied in a variety of neurosurgical cases. After resection of an arteriovenous malformation, there was postoperative hyperperfusion of the surrounding brain parenchyma, which was consistent with a loss of autoregulation. Bypass patency and increased perfusion of adjacent brain were documented during two of three extracranial-intracranial bypasses. In seven of nine patients with epilepsy the results of DIR imaging corresponded to seizure foci that had been electrocorticographically mapped preoperatively. Dynamic infrared imaging demonstrated the functional cortex in four of nine patients undergoing awake resection and cortical stimulation. **Finally, DIR imaging exhibited the distinct thermal footprints of 14 of 16 brain tumors. Dynamic infrared imaging may prove to be a powerful adjunctive intraoperative diagnostic tool in the neurosurgical imaging armamentarium. Real-time assessment of cerebral vessel patency and cerebral perfusion are the most direct applications of this technology.** Uses of this imaging modality in the localization of epileptic foci, identification of functional cortex during awake craniotomy, and determination of tumor border and intraoperative brain shift are avenues of inquiry that require further investigation.