Technology and the Operating Room

In these days when science is clearly in the saddle and when our knowledge of disease is advancing at a breathless pace, we are apt to forget that not all can ride and that he also serves who waits and who applies what the horseman discovers.

Harvey Cushing

The role of neurosurgery in the management of brain tumors was made possible in large part by the pioneering work of Harvey Cushing in conquering one of the great barriers to tumor extirpation: the control of bleeding. His first technologic contribution occurred in 1910 with the introduction of the Cushing clip, which enabled the surgeon to staunch hemorrhage from larger vessels. In 1926, he achieved a major breakthrough when, working with William T. Bovie, a Harvard Cancer Commission physicist, he introduced the use of electrosurgery including loop cautery and electrocoagulation.

With the ability to control infection, intracranial pressure, and hemostasis and the introduction of new radiologic capabilities, the neurosurgeon had the basic tools to approach brain tumors with some reassurance that complications could be managed. The difficulty with this approach to intracranial neoplasms, perhaps more than with any other ablative surgery, remained the invasion and destruction of the normal surrounding brain tissue. As Cushing put it, “A physician is obligated to consider more than a diseased organ, more even than the whole man—he must view the man in his world.”

In 2005, we are witnessing a Cambrian-like extension of the neurosurgeon’s skill through the introduction of new technology. This is made possible by a broad range of developments in many areas of bioengineering. The McPherson and Sawaya paper on new operating room tools will introduce non-neurosurgeons to frameless stereotaxis, probes with light-emitting diodes, fiducials, computed neuronavigational systems, intraoperative MRI, cortical mapping, somatosensory-evoked potentials, endoscopic third ventriculostomies, and endonasal endoscopes. The capabilities that this impressive array of sophisticated technologies confers to the surgeon is the ability to more precisely define the boundaries between normal and neoplastic tissue and to excise tumors up to these boundaries. Some of these tools may appear almost macabre, such as a craniotomy on an awake patient so that the speech area location can be constantly monitored and avoided. However, the result is a patient who can move back into the world with as much function as possible.

Another of Cushing’s sayings that may prove prophetic (although in a different context) was, “I would like to see the day when somebody would be appointed surgeon somewhere who had no hands, for the operative part is the least part of the work.” As McPherson and Sawaya point out, we are just beginning to apply the new science of robotics to the central nervous system, and the potential for added benefit may be profound. The ability to manipulate instruments guided by a concurrent intraoperative MRI will truly enhance the wizardry of the neurosurgeon as he or she microscopically dissects out the marauding tumor and spares the normal neurons so essential to a productive and satisfying life.

References