metal alloy clips is clearly larger than that produced by the titanium clip.

At present, it is unclear whether MR angiography will play a significant clinical role in the evaluation of vasospasm. However, refinements in aneurysm clip design have significantly reduced signal artifact, rendering MR angiography possible.

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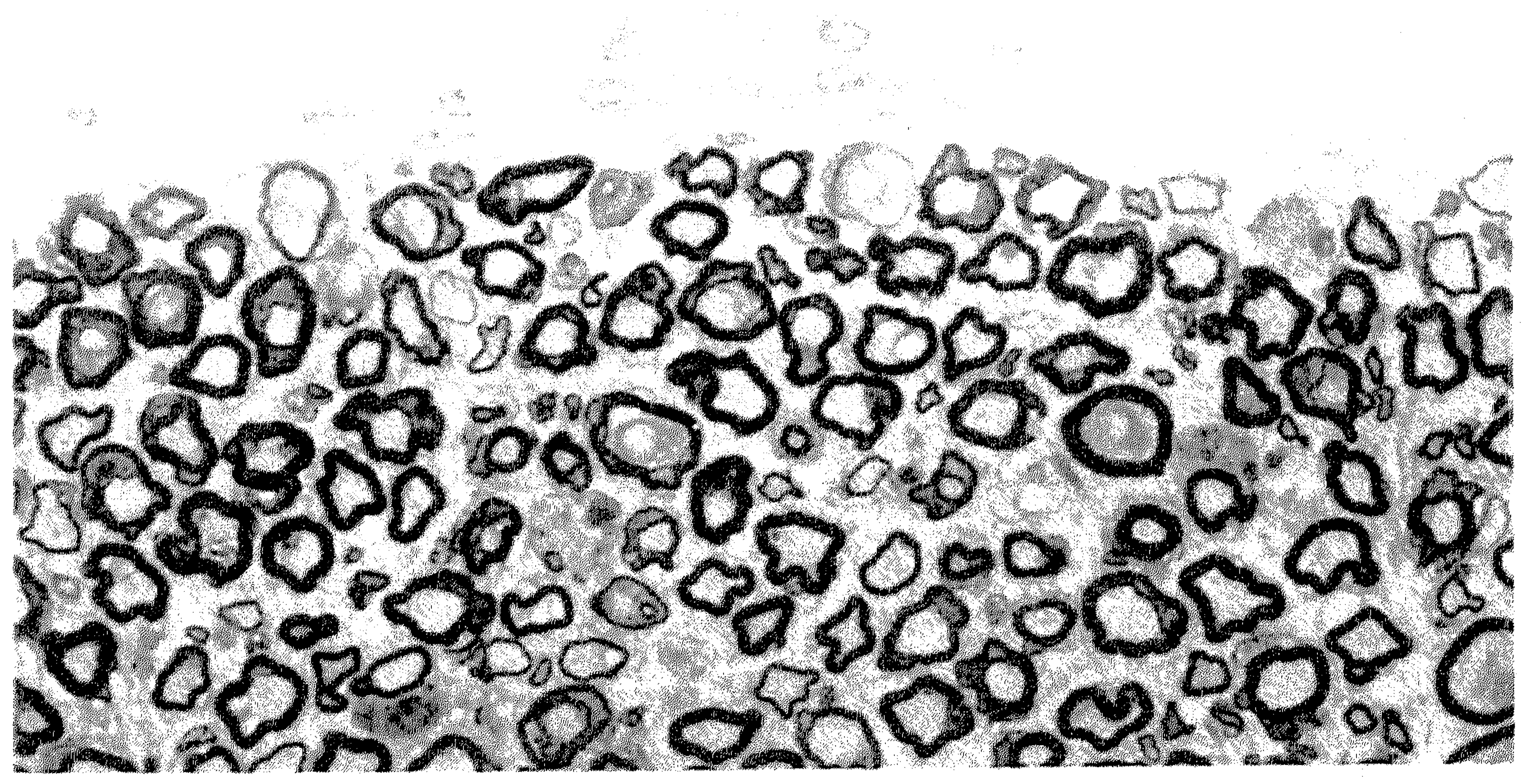

FIGURE 2. Photomicrograph of a semithin cross-section of a human oculomotor nerve proximal to the cavernous sinus. The nerve lacks a firm epi- and perineurium and is enveloped by only a double cell layer (toluidine blue; original magnification, ×400).

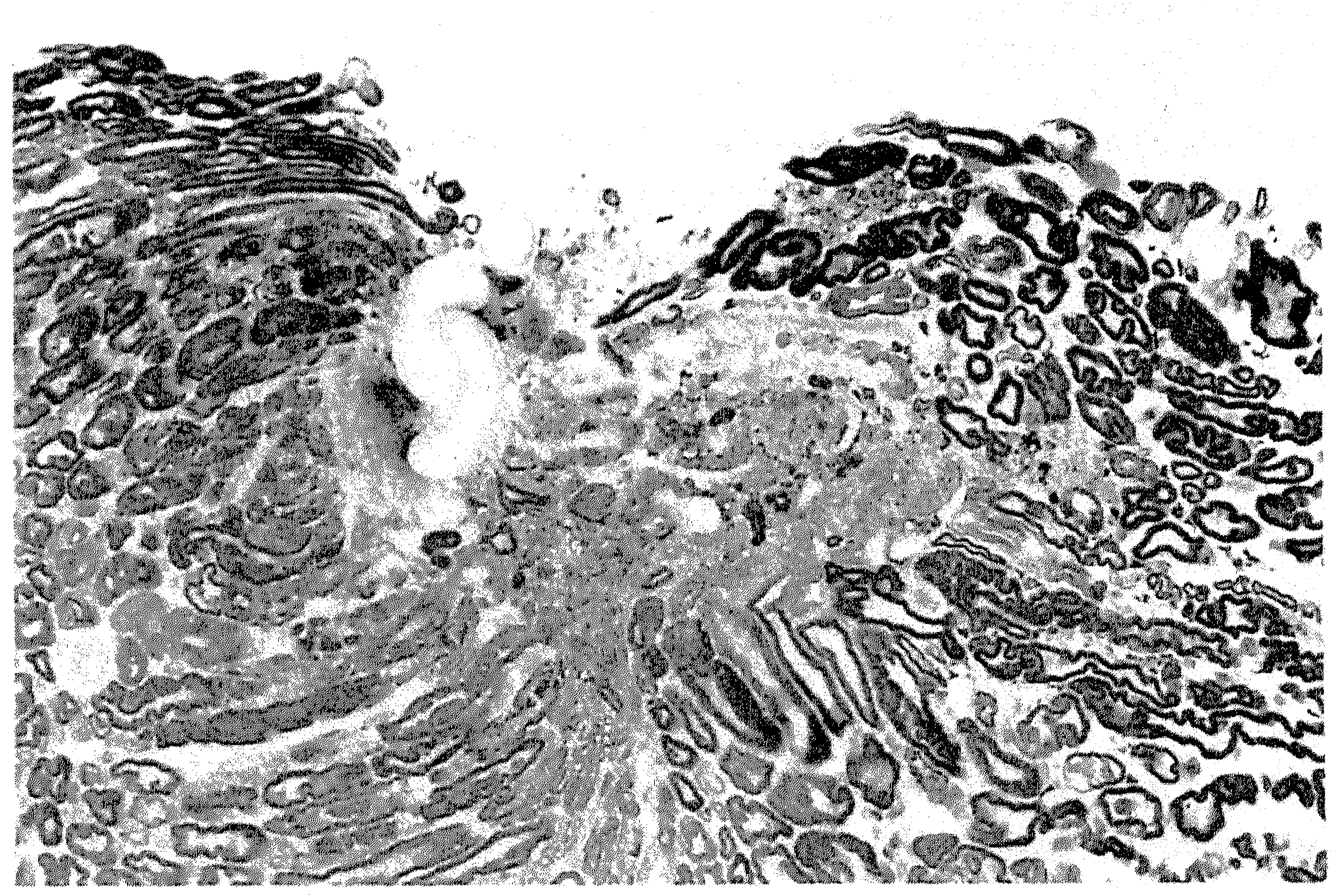

FIGURE 3. Photomicrograph showing a longitudinal section of a rat oculomotor nerve directly after microsurgical repair by a single 10-0 nylon suture. Note the disorganization of the axons at the repair site (toluidine blue; original magnification, ×100).

Full Functional Recovery after Surgical Repair of Transected Abducens Nerve: Case Report

To the Editor: We read with great interest the article by Sawamura et al. (14) describing intracranial repair of a transected abducens nerve. The functional recovery after such a repair is impressive, and the reported case, supported by others (15, 16) clearly shows that abducens nerve repair should be pursued whenever possible.

Our comment is focused on the method of nerve repair. The authors performed end-to-end repair of abducens nerve using five (!) 10-0 nylon sutures. It is known from peripheral nerve surgery that too many sutures have a negative influence on nerve regeneration (5, 9). This applies even more to intracranial nerves, because those nerves lack a firm connective tissue layer (*Fig.* 2) (11). In our experiments on intracranial nerve repair in rats, the mechanical damage induced by insertion and knotting of the sutures in an intracranial nerve (*Fig.* 3) is very impressive (Menovsky T, van Overbeeke JJ, unpublished results). In the chronic phase of healing, too many sutures will result in foreign body reaction, scar, and neuroma formation, all of which have negative effects on functional outcome (3).

The authors state that the use of fibrin glue for intracranial nerve repair is not recommended because of the following: 1) it prevents revascularization of the transected nerve, and 2) the effects of fibrin glue in the subarachnoidal space are not known. The use of fibrin glue for nerve repair is based on the bonding properties when two substances of fibrin glue, thrombin and fibrinogen, are mixed (10). Fibrin glue simulates the natural clotting process of blood. Application of fibrin glue results in a viscous white elastic mass that adheres firmly to tissue. In the course of wound healing, the glue is completely absorbed. There are many reports on the use of fibrin glue in peripheral and intracranial nerve repair, and its efficacy and even superiority over sutures has been frequently demonstrated (1, 2, 4). In a study of oculomotor nerve repair in cats, Sandvoss et al. (13) claim to have achieved superior results using fibrin glue (Tissucol; Immuno A.G., Vienna, Austria), with ideal parallel alignment of the nerve fibers at the repair site. We have not encountered any adverse effects of fibrin glue (Tissucol) when applied in the subarachnoidal space (for sealing of dural leakage, repair of intracranial nerves, or wrapping of an unclippable aneurysm with a muscle of cotton), nor are we aware of any complications of fibrin glue reported in the neurosurgical literature.

In conclusion, there are no reasons why fibrin glue, eventually in combination with one or two nylon sutures, should not be used in a tension-free repair of intracranial nerves (6–8, 12). We do not recommend the use of Surgicel (oxidized regenerated cellulose) in combination with fibrin glue, because it has been shown that its use is accompanied by neuroma formation, adhesions, and atrophy of the nerve with impaired recovery (13).

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Repairing Holes in the Head: A History of Cranioplasty

To the Editor: I enjoyed reading the thorough history of cranioplasty techniques reported by Sanan and Haines (1). Those interested in cranioplasty "firsts" may want to add the following example of surgical ingenuity to Sanan and Haines' extensive collection. In June of 1891, D. Thomas of Oldtown, TN, was compelled to operate for an open brain wound with no assistance except "the help of a few neighbors," one of whom administered the chloroform. During the operation, Thomas observed that the cranial defect was larger than he had expected.

> The thought occurred to me while trephining, how subjected the brain was to external injuries should osseous formations fail to fill the cavity produced by trephining. I at once conceived the idea that a metal plate placed over the punctured part would afford ample protection. In pursuance of this idea, I at once prepared a quarter of a dollar by immersing it in boiling water for a few minutes.... I raised the compressed bone and placed silver over the punctured and trephined part.

The patient achieved an excellent recovery and sustained a second blow on the identical spot only 4 weeks later, without injury (2). In addition to being possibly the first modern use of silver as a cranioplasty material, this was the first instance (to my knowledge) of the repair of a cranial defect using United States currency.

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Intraoperative Diagnostic and Interventional Magnetic Resonance Imaging in Neurosurgery

To the Editor: We have read the article by Tronnier et al. (1) with great interest. The following comments show the controversial perception of this new field. As a team working with the 0.5-tesla Signa SP (General Electric) open interventional MR imaging (MRI) system since 1995, we are convinced that this system will have a major impact on neurosurgery. The General Electric system, in contrast to the system used by Tronnier et al. in Heidelberg, Germany, allows intraoperative imaging during surgery. Current and future options include real-time neuronavigation, thermosensitive imaging, and real-time functional imaging. Neurosurgical procedures in the General Electric open interventional MRI system are dependent on MR-compatible instrumentation. One of several unsolved problems concerning instrumentation for use in the open interventional MRI system is bipolar cautery. The two systems that are currently commercially available have been tested in Zurich, Germany. Because of the reduced electrical conductivity of titanium alloys used for bipolar forceps, we experienced either insufficient cauterization or troublesome carbonization producing sticking of the tips of the forceps. This makes continuous cleaning necessary and considerably prolongs the surgical procedure. Furthermore, MRI during cauterization is impossible. In search of a solution to this problem, we tested a new contact laser provided by Surgical Laser Technologies (Montgomeryville, PA), with Wavelength Conversion surface treatment in an ablative case of therapy refractory epilepsy at the neurosurgery department of the University of Virginia. The round probe for coagulation was very effective and was not associated with sticking of the probe or charring, and the hemostatic effect was excellent. The general purpose laser scalpel has good cutting characteristics. However, during this case, several small arteries were opened by the scalpel and the laser energy had to be increased to 15 W to provide a satisfactory hemostatic effect. Further development will include a laser forceps and a flat tip for cutting and coagulating. Because this laser system is MRI-compatible, we think it will contribute significantly to the exciting new field of open MRI neurosurgery.

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