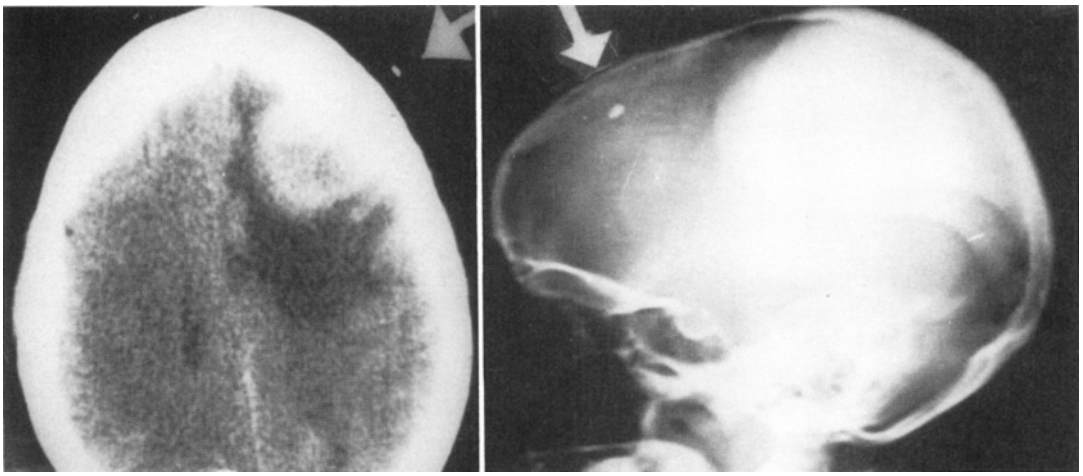

FIG. 1. The marker artifact *(arrows)* is seen opposite the center of a tumor on a computerized tomography scan *(left)* and a scout x-ray film *(right)*.

a convexity brain tumor on the scalp. Technical note. *J Neurosurg 66*:474–476, March, 1987). Ebeling, *et al.*,[1] have also described such a use of CT. Even with the most meticulous care, however, calculations occasionally miss the target by a few centimeters.

As a final check, it is possible to simply place a radiopaque marker over the calculated lesion site and obtain a single CT "slice" that demonstrates both the tumor and the marker. If incorrect marking has occurred, recalculation and remarking can be performed. After correct placement of the marker, direct marking of the scalp serves as a reliable reference point for the surgical skin flap. This can be performed during the original CT examination at the end of the contrast study.

Figure 1 demonstrates the artifact opposite the center of a tumor on CT and on the scout views.

S. CONSTANTINI, M.D.
S. POMERANZ, M.D.
J. M. GOMORI, M.D.
Hadassah Medical Organization
Jerusalem, Israel

Reference

1. Ebeling U, Huber P, Reulen HJ: Localization of the precentral gyrus in the computed tomogram and its clinical application. **J Neurol 233**:73–76, 1986

RESPONSE: I certainly welcome the final verification procedure by Constantini, *et al.* This method will assure the neurosurgeon that the area of approach on the scalp, calculated by the neuroradiologist, indeed corresponds with the actual site of the brain lesion as diagnosed by computerized tomography.

PROF. DR. L. PENNING
University Hospital of Groningen
Groningen, The Netherlands

Preparation of Vein Bypass Grafts

TO THE EDITOR: I read with interest the review article regarding the preparation of vein bypass grafts (Sundt TM III, Sundt TM Jr: Principles of preparation of vein bypass grafts to maximize patency. *J Neurosurg 66*:172–180, February 1987). I must disagree with several points however, the main one being the statement that "The addition of papaverine to the storage solution has been shown to prevent the spasm, but it renders the vein walls more sensitive to injury by distention under pressure."

In a series of experiments, LoGerfo, *et al.*,[1-4] developed a clinical technique for prevention of spasm, and demonstrated with scanning electron micrographs the essentially total preservation of endothelium in vein grafts and elimination of the pseudointimal hyperplasia that is referred to in the article by Sundt and Sundt as alterations due to "arterialization." Basically, the technique involves perivenous infiltration of a dilute papaverine solution, extreme gentleness in the dissection of that vein, early cannulation and distention with a Shiley vein distention system using a warm papaverine solution consisting of 60 mg of papaverine, 2000 U of heparin, and 500 cc of plasmalyte, and storage of the vein in the distended state in the same solution at 4°C.

A fortunate consequence of the early infiltration with a papaverine solution is that working with the large nonspasmodic vein is technically much easier and its true size can be better appreciated. With intact endothelium, smaller-caliber veins with a diameter equal to that of the outflow vessels can be used successfully rather than only the "5- to 8-mm" size mentioned in the article.

Placing the "Garrett line" does not insure against kinks and twists and may add to the trauma of the vein. The best way to insure against twists is to perform the proximal anastomosis on the distended vein first, let

the force of the blood at systemic pressure unfold any kinks, mark the anterior surface with a gentle bulldog clamp and a marking pen, and then perform the distal anastomosis in the correct orientation.

Provided that a technically correct anastomosis is performed in the presence of adequate inflow and outflow, it is clear that the short- and long-term patency rates are dependent on an optimal conduit. The benefit in providing an endothelial-lined graft is well worth the effort involved.

CHARLES C. PANISZYN, M.D.
Providence Veterans Medical Center
Providence, Rhode Island

References

1. Haudenschild CC, Gould KE, Quist WC, et al: Protection of endothelium in vessel segments excised for grafting. **Circulation 64 (Suppl 2):**101–107, 1981
2. LoGerfo FW, Haudenschild CC, Quist WC: A clinical technique for prevention of spasm and preservation of endothelium in saphenous vein grafts. **Arch Surg 119:** 1212–1214, 1984
3. LoGerfo FW, Quist WC, Cantelmo NL, et al: Integrity of vein grafts as a function of initial intimal and medial preservation. **Circulation 68 (Suppl 2):**117–124, 1983
4. LoGerfo FW, Quist WC, Crawshaw HM, et al: An improved technique for preservation of endothelial morphology in vein grafts. **Surgery 90:**1015–1024, 1981

RESPONSE: We appreciate Dr. Paniszyn's comments concerning our article. Our statement regarding papaverine and the sensitivity of the vein wall to distention under pressure was based on the work of Baumann, *et al.*,[1] as referenced in our paper. In their study, canine cephalic veins were harvested, distended, and stored in various solutions. Of note, unlike the technique described by LoGerfo,[2–4] in this study the veins were not maintained in the distended state. The veins that were distended with plasmalyte containing 0.6 mg/ml of papaverine hydrochloride and "briefly" distended to 100 mm Hg in order to check for untied or avulsed branches demonstrated separation of most of the endothelial cells from one another, leaving large gaps with exposed subendothelial connective tissue, whereas those perfused with papaverine only demonstrated good preservation of the endothelium after distention. Given this concentration of papaverine, we believe that our statement holds true for these data. The experiments cited by Dr. Paniszyn employed a much lower concentration of papaverine; 60 mg/500 cc of plasmalyte, or only one-fifth of that used by Baumann, *et al.*[1] Indeed, the technique of LoGerfo, *et al.*,[2–4] does seem to afford excellent endothelial preservation, although it is a somewhat complex system.

We have used veins 2 to 3 mm in diameter from the superficial temporal artery to the posterior cerebral artery (PCA) or to the M_2 trunk of the middle cerebral artery and they have functioned quite well. However, for the longer graft running from the external carotid artery to the proximal PCA, we have found veins of this caliber to be too small to assure patency. True, we have had some remain patent, but the reliability is not that of a larger vein in this situation.

The Garrett line is placed in the adventitia or the loose areolar tissue superficial to the adventitia of the vein and does not traumatize the vein. With an extracranial to intracranial bypass graft, a considerable portion of the graft pathway is unobserved in the subcutaneous tissue and deep fascia of the neck and face. We have found that the Garrett line is the best way in our hands to prevent a twist, and we believe that this is a reliable method.

The intracranial anastomosis is performed under the operating microscope at a depth approximating 6 to 8 cm (depending on the size of the skull) measured from the edge of the wound and drapes. The area at the bottom of the wound for working space is elliptical, and the longer of the two axes approximates 1.5 cm. To our knowledge, this is unique among surgical procedures, and there is no peripheral vascular procedure which approximates the problem encountered in this type of operation. Technically, it is much easier to perform the intracranial anastomosis first as this limited working space makes it necessary that the surgeon be able to move the vein from one direction to another in order to alternately expose both sides of the vein for the medial and lateral suture lines. An extracranial to intracranial bypass vein graft necessarily takes a right-angled turn as it crosses the zygoma and thereafter follows a circuitous course across the floor of the middle fossa to the point where it is anastomosed to the PCA at about a 45° angle. It has been our experience that the vein tends to kink at the point where it takes a right angle, and it is at this point that it is necessary that the vein retain its initial or *in vivo* orientation rather than simply the orientation achieved by distending the vein after it has been harvested.

It appears that the smooth muscle of the vein follows a rather oblique course rather than a transverse orientation, because when the vein is distended after it has been harvested a thin suture placed in the adventitia follows a gradual rotational course which, depending upon the length of the vein harvested, can reach a 360° rotation from one end to the other. Furthermore, it is easier to maintain this proper orientation with a Garrett line in the loose areolar tissue surrounding the vein than it is to rely on the distended orientation of the vein.

The comments regarding infiltration with the papaverine solution are excellent and we will try this technique. We thank Dr. Paniszyn for bringing this to our attention and to the attention of the readership.

THORALF M. SUNDT, JR., M.D.
Mayo Clinic
Rochester, Minnesota
THORALF M. SUNDT III, M.D.
Massachusetts General Hospital
Boston, Massachusetts