Determination of Vascular Status of Pedicle Skin Flaps by the Use of $^{99m}$Tc-Pertechnetate

W. Newlon Tauxe and K. Hamamoto

Section of Clinical Pathology, Mayo Clinic, U.S.A.

P. R. Lipscomb

Section of Orthopedics, Mayo Clinic, U.S.A.

J. N. Simons

Section of Plastic Surgery, Mayo Clinic, U.S.A.

Surgeons have conventionally severed pedicle grafts at 21 days postoperatively. This empirically derived time is too short for some patients but, for the majority, it may be too long. It would be advantageous to be able to determine the optimal severance time for the individual patient.

Pedicle-graft evaluation studies were carried out in 44 patients, 37 males and 7 females ranging in age from 6 to 77 years. The patients were studied one to four times each, from the fifth to the 131st postoperatively.

After the pedicle graft is exposed, an infant sphygmomanometer cuff is wrapped around the pedicle as close as possible to the donor end. A $\frac{1}{2} \times \frac{1}{2}$ inch NaI scintillation detector is placed over the center of the recipient end of the pedicle, 10 µCi of $^{99m}$Tc pertechnetate in a volume of 0.1 ml is injected subcutaneously. The counting rate is determined at 1 minute intervals for 10 minutes at which time the cuff is inflated to exceed systolic pressure. The radioactivity is determined for another 10 to 15 minutes, at the end of which the cuff is deflated. The disappearance of isotope is followed until 1 hour has elapsed from the time of injection. The logarithm of the counting rate is plotted against the time. A line is drawn through the straight terminal segment of the curve and extrapolated by eye to connect with the curve at the point when the graft was occluded. From this extrapolated curve a straight line is drawn through the occluded period, from which one estimates the disappearance rate which would have obtained had there been no occlusion (disappearance rate constant: $\lambda_1$). A line is then drawn through the curve which actually obtained during the occluded period (rate constant: $\lambda_2$). $\frac{\lambda_1}{\lambda_2} \times 100$ is designated "percentage flow". It may be subtracted from 100 to give a value designated "percentage block".

The pedicles were severed 10 to 133 days postoperatively. In general, severance was delayed longest in the group with lesions in which radiation damage had been a factor. The average percentage block estimated at time of operation was 26%. The range of block was 88 to 0%. Estimated block at 21 days is the least in cases of simple trauma. In other clinical categories (actinodermatitis, persistent ulcer, osteomyelitis, rheumatoid arthritis, and malignancies) the mean block values were higher at 21 days. Three patients in the series had greater than 80% block on the 21st days.

We found the test to be useful, nontraumatic, and relatively easy to perform. It has effected an actual saving of an average of 6.3 hospital days in the 23 patients who would have undergone graft severance at 21 days. More important, it indicated the need for a delay in cases in which severance at 3 weeks might have resulted in necrosis.