

## 29. *Methods of Handling the Neurovascular Bundles*

THE fixed position of the neurovascular bundles coming out of their bony foramen has always had a restraining effect against successful pushback procedures.

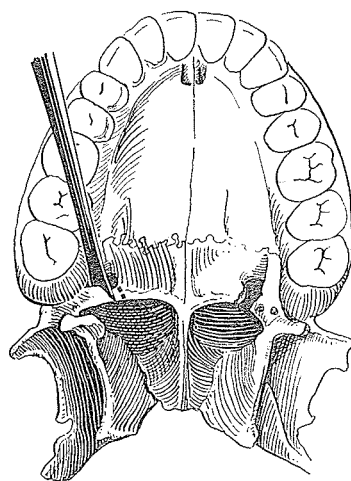
### BLUNT FREEING AND TUGGING

Timid and gentle surgeons have been content to tease the bundles free or pull them gently from their bony exits, achieving an apparent stretch but probably with an ineffective gain. MacCollum at Boston Children's Hospital about 1944 used to describe this maneuver "like a robin pulling an earthworm out of its hole." Yules used the same description 30 years later.

### OSTEOTOMY

Alexander Limberg of Leningrad evaluated the costs and, deciding that bone was more expendable than blood supply, proceeded to plan resection of the posterior wall of the foramen. In his paper "Neue Wege in der radikalen Uranoplastik" in 1927, he stated:

The artery palatine major should be freed together with the periosteum circumferentially. Then follows the "Resectio margina foramines palatini,"—the posterior and medial edge is resected by a chisel. The neurovascular bundle can now be easily moved from the canal posteriorly and medially.



Herbert Conway of Cornell University Medical Center expressed his preference for Limberg's osteotomy in 1947.

Since preservation of the blood supply and the innervation of the soft palate are in keeping with the principles of reconstructive surgery, the thought occurred that the freeing of the neurovascular bundle from its bony environment would overcome the objection offered to Brown's technique for push-back operation and yet allow for the effective performance of the procedure in one stage. The osteotomy is performed with a small chisel . . . a thin plate of bone, 3 to 4 mm. in width and 1 to 1.5 cm. in vertical dimension, is removed—after the osteotomy is completed, the palate is dislocated posteriorly so that the palate touches the posterior pharyngeal wall.

In 1962 Ohmori of Tokyo noted:

Doctor Tange, one of our co-workers, devised a special chisel for the operation of cleft palate with which the bone surrounding the major palatine artery is cut off.

In 1964 R. Ruding of the Netherlands observed that during palate closure

The greater palatine artery should also be displaced backwards, especially because the greater palatine foramen is relatively forward from its normal position in the case of cleft palate. If not displaced posteriorly, the neurovascular pedicle will tend to keep the muscular mechanism forward, and this in turn will lead to reattachment of the muscle in its original position. Veau states that it is possible to pull the artery from the palatine canal but I find this quite impossible. . . . The posterior rim of the foramen is quite angular, and during a push-back of the tensor-levator system the artery will ride over the sharp edge. Because the vessel may be unnecessarily pinched or kinked as it rides over the rim, it is useful and easy simply to chisel away a portion of the back wall of the greater palatine foramen.

Although the Limberg osteotomy became popular, was used by many surgeons and is used in some clinics today, there were some surgeons who objected. Stefan Demjen, who favored dividing the vessels, argued:

I always have objected to using chisel and hammer for "retrodisplacement" of the bundles for two reasons: (1) osteotomy is a traumatizing procedure, (2) the retrodisplacement gained in this way can be effective only if it is done extensively, which is an unpredictable procedure and can do more harm than help.

## DIVISION OF THE BUNDLES

The more radical surgeons actually divided the neurovascular bundles on purpose. As noted by McDowell, George Dorrance advocated cutting the major arteries; it had always been his contention that in a correctly performed von Langenbeck operation the posterior arteries were divided. He was not concerned that his procedure did the same and defended his stand in 1925:

Does not this method predispose to sloughing of the flaps? In the cases I have observed so far, I have noted less blanching of the flaps than in my usual cleft palate operations. There has been no sloughing. The blood supply comes in through the tonsillar plexus.

Yet in later papers Dorrance advocated a preliminary operation to cut and tie the arteries while raising the flap, considering it safer to delay the flap.

Other surgeons, like Axhausen, Wardill, Browne, Hynes, Cuthbert and Demjen, also were determined to sever this tether and achieve their objective at all cost. With or without a delay, they simply ligated and divided or cut and twisted the vascular bundles. The soft palate was thus definitely freed from its moorings to the hard palate and allowed to drift back toward the pharynx.

As early as 1933 Wardill wrote his thoughts on the division of the posterior palatine artery during palate surgery.

A great deal has been written about the necessity of preserving this vessel, and while I would not advocate its division as a routine procedure, on the occasion when I have done this by accident or design I have seen no ill results following. Sometimes it is essential to divide both vessels so as to bring the two halves of the palate *together without tension*.

A rare combination of Hughlett Morris of the University of Iowa and Stefan Demjen of Comenius University, Bratislava, in a 1978 book, *The Bratislava Project*, described and evaluated Demjen's modification of the W-V-Y palate pushback in which he ligates the posterior palatine vessels. Morris concluded:

The studies in the Bratislava Project which relate to general maxillofacial growth and development indicate that severance of the neurovascular bundle is not greatly detrimental to the growth and development of the midface.

## THE COST

In 1959 Broadbent and Hochstrasser studied mongrel puppies after division of the descending palatine nerves and found no gross or microscopic atrophy of mucous glands or muscle tissue and no paralysis. In two human cleft palate cases, however, they sectioned the left neurovascular bundle and found that the half of the palate on the sectioned side was 3.0 to 3.5 mm. shorter than that on the control side with a reduction in palatal bulk. Secretory activity of the mucous glands on the sectioned side many months later was approximately one-fourth that of the normal side. These findings confirmed an obvious dictum: Unnecessary division of the neurovascular bundle is contraindicated. In fact, the authors went even farther:

Section of this neurovascular pedicle is not permissible in palate repair in humans without fear of atrophic shrinkage.

## DISSECTION OF THE NEUROVASCULAR BUNDLE OFF THE FLAP

As early as 1940 James Barrett Brown of St. Louis had found a way to preserve the vessels but achieve lengthening without sectioning the posterior foramen wall:

Preservation of the major palatine arteries is possible in nearly all patients, and freeing is effected by careful loosening of all tissues around the artery, gently stretching it from the foramen and, if necessary, cutting it away from the palate flap. These methods have seemed better than trying to dislodge the artery from its bony canal by trying to remove the posterior wall of the canal.

Frank McDowell, with M. Fryer and J. B. Brown, described the procedure in greater detail in 1954:

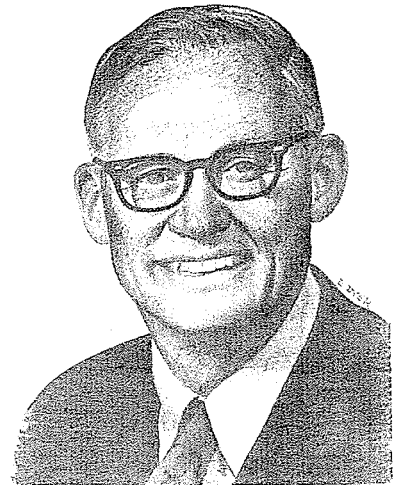
The arteries are stretched out of the bony canals and partially loosened from the palate flap, but are left intact. If there is any question as to the length of the arteries, they should be carefully freed from the palate flap for a distance of 1 to 1.5 cm. forward before the elongation is done. They must be loose enough to completely change directions and even run backward a little ways after the palate is set back.

Peter Randall recalls teaching residents to dissect the vessels off the mucoperiosteal flap in 1954 at Barnes Hospital.

## SHARP DISSECTION OF VESSELS

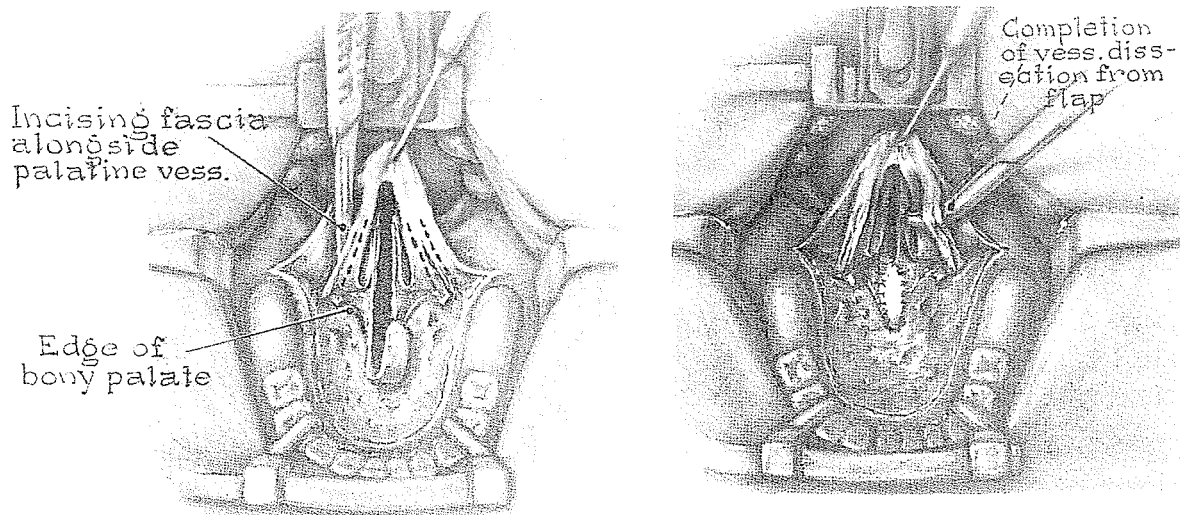
Milton T. Edgerton, a soft-spoken Georgian with the ecclesiastical presence of a clergyman, inherited the position of chief of plastic surgery at Johns Hopkins Hospital after the death of Edward Hanrahan. In 1961 Edgerton first gave his old teacher credit for the general idea of freeing the neurovascular bundles:

J. B. Brown in 1936 made an important addition to the surgery of partial clefts by "mobilizing, but not cutting, the major palatine arteries from their foramina." He was able to get the vessels in all instances to stretch or elongate sufficiently for the palate to touch the posterior pharyngeal wall at the end of the operation.



Milton Edgerton

In 1962 in *Plastic and Reconstructive Surgery* Edgerton mentioned his own occasional unhappy experience with a "blunt" approach, attributing it to the limited length of the neurovascular bundles. He then reported his series of 50 cases in which he had freed the neurovascular bundles extensively by sharp dissection from the mucoperiosteal flaps. He noted interesting anatomical findings:



The three descending palatine nerves course forward closely parallel to the major palatine artery and . . . by the division of two tiny minor palatine

arteries near the greater palatine foramen, the major palatine artery and descending palatine nerves can then be dissected free from the palatal mucoperiosteal flap for a distance of some 2 cm. anteriorly without encountering other major branches. It may be seen that for every centimeter that one dissects the neurovascular bundle free from the palate flap, he gains approximately 2 cm. in posterior mobility of the palate flap. . . . The technique is of value, both in repair of complete and partial clefts of the palate.

In 1976 Edgerton wrote me:

Sharp dissection of the neurovascular bundles may be the most important contribution that I have made to this complex subject. That simple device, for the first time, made it possible for me to place the mucoperiosteal flaps at any point I wished, in the process of retropositioning the palate.

Demjen enumerated Edgerton's 1962 reasons for preserving the major palatine arteries during lengthening procedures:

(1) The actual circulatory safety of the palatal flaps during the healing period, (2) the later bulk and secretory activity of the palatal mucous glands, (3) the actual length of the soft palate, (4) sensation and taste in the repaired palate, and (5) subsequent growth of the underlying bones

and then proceeded to attack Edgerton's claim with:

These statements are in contradiction with my personal experience and clinical observations.

#### IF IN DOUBT, DON'T, OR SAVE THE VESSELS

Although the neurovascular bundles do tend to tether the soft palate to the hard palate, there seems to be no real justification for dividing them. It is not likely that their division will be catastrophic for either blood supply or growth. Yet if they can be freed from the foramen or the flap, and if necessary the restricting posterior wall of the foramen can be removed, there is no need to divide them. It takes a little more time and skill, but these vessels can be of great value under certain circumstances. If they have been destroyed at leisure, they are alas no longer available for important duty in an emergency!