

severed. Therefore, the only plausible explanation for the mechanism of feeding motor activity in the jejunum in the human being is control by hormones.

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### DISCUSSION

DR. WILLIAM E. NEVILLE (Newark, New Jersey): The technique of free bowel transplant with anastomosis of the accompanying artery and vein has intrigued me since a report by Seidenberg and the late Elliott Hurwitz at the *Surgical Forum* in 1959 of their successes in dogs. Subsequently, in my laboratory during the 1960's countless dogs met their demise as a result of our attempts to duplicate their results. The arterial anastomosis was not a problem, but the venous connections were insurmountable.

Obviously, in the 1960's we did not have fine monofilament sutures or sophisticated microsurgical techniques that were easily adaptable. With the advent of coronary artery operations, all of this has changed, and it is possible that the operation described by the group from Duke may well become the procedure of choice in the future.

In addition, we now not only have the expertise for adequately performing the vascular anastomoses, but have at our disposal stapling instruments, popularized by Mark Ravitch, and his former associate, Felix Steichen.

In regard to stapling techniques, it is interesting that Nakayama in 1964 reported 21 patients in whom autografts of the bowel were used to reconstruct the cervical esophagus, using a stapler for the vascular anastomosis.

Thus, at the present time we have several options for primary reconstruction of the cervical esophagus, thereby eliminating the multiple-staged Wookey procedure. We have the free transplant, as

depicted in the previous paper; we have the gastric sleeve originally reported by Gavriiliu, which can be done fairly quickly with the GIA stapler and the use of an ileocolic segment which retains its original vascular connection in the abdomen.

The ileocolic segment can easily be transplanted from the abdomen into the neck through the anterior mediastinum. My experience over the years using the right colon and leaving an attached segment of terminal ileum, as described by George Clowes and me nearly 25 years ago, has made this technique preferable with me for reconstructing all or part of the esophagus. The only impediment that mother nature may not be kind enough to give one the blood vessel distribution to perform the procedure with a reasonable sense of security in all patients.

My experience with pharyngolaryngo-esophagectomy without a neck dissection, has been limited to six patients. In all of the patients the ileocolic segment was used successfully to establish oral-gastric continuity.

These three slides depict a patient with a large cervical carcinoma on whom Dr. Rush and I both operated. The first slide shows a large lesion in the cervical esophagus which has invaded the pharynx and the larynx. We removed en bloc the larynx and the cervical esophagus but did not do a concomitant neck dissection.

The second slide shows the terminal ileum anastomosed to the pharynx. There is some slight narrowing in that area, but this had no difficulty in swallowing. The last slide shows the dilated colon retrosternally in the anterior mediastinum.

I must add that in the long run peristalsis in the graft is meaningless clinically. The cine studies that we reported in the late 1950's showed that over a period of time there was no evidence of peristalsis in the colon transplant. It merely acted as a conduit from the mouth to the stomach.

Despite my lack of experience with the free transplant in patients, I enthusiastically endorse this operation, and re-emphasize that at the present time, with all of our newer advances in microsurgery and gastrointestinal stapling techniques, this may well be the operation of the future.

**DR. ROBERT F. RYAN (New Orleans, Louisiana):** I congratulate the authors on their superb technical achievement and the excellent physiologic studies which they have conducted. I would like to point out that cervical esophageal replacement can occasionally be done by much simpler means. In 1975 Dr. Kremenz and I resected the tongue, larynx and epiglottis of the third cancer that the patient had had. She had already had a partial glossectomy. We made a gullet out of the remaining floor of the mouth and tongue.

Five years later, the patient returned with her fourth cancer. [slide] This was in the cervical esophagus. Dr. Kremenz asked me to help, and after he had resected the cancer left us to close the hole. The hole that we had is depicted here by a drawing. The patient had a distal esophagus at the level of the tracheostomy, two tired and heavily irradiated skin flaps in the form of a T where it had been resected. We were looking in at the two carotid arteries, the prevertebral fascia, and the uvula hanging down in the middle from the nasopharynx.

We made a large pectoralis major myocutaneous flap, and we sewed it to the nasopharynx, the remaining floor of the mouth, and then by folding it in a spiral fashion we made an esophageal tube.

(slide) The total time for the resection and the reconstruction was less than five hours. All wounds were closed primarily, without any grafts being done. This shows the patient with the chest wound closed and the T incision in the neck closed.

The patient refused to lose her security blanket of the nasogastric tube and went home with it in place. The tube became dislodged three weeks later. She returned unable to swallow well. We presumed that she had an esophageal stricture. We performed an esophagoscopy and found that there were no strictures present. We then were readily able to pass the nasogastric tube.

We then realized, however, that she was using her left hand to drink with, and when she did this, with the myocutaneous flap still being innervated, any time she used her left arm the muscle was closing off the flap. So we had an iatrogenic stricture caused by that method. We taught her to use her right hand to drink with, and now she is able to swallow correctly.

It may be that we are going to have to denervate some of these flaps.

Dr. Kremenz took this patient's first cancer out some 16 years ago. This is her fourth cancer. The patient has continued with her martinis and her cigarettes, so perhaps the fifth cancer that she has will be in the area of thoracic surgery.

**DR. M. J. JURKIEWICZ (Atlanta, Georgia):** I believe that microvascular surgery has come of age such that one must be able to operate with technical expertise resulting in few if any failures from vascular anastomoses.

The germ of this particular idea originated with Dr. Longmire in the middle 1940's. To reconstruct the cervical esophagus in a patient with a lye stricture, he transplanted a segment of jejunum into the neck, using an abdominal skin tube as a carrier. Obviously, this is a tedious process, with hazards all along the way. Consequently, in another patient with a similar stricture he did a remarkable thing. He took a Roux loop and to lengthen it used an additional segment, leaving the axial vessels long, and then revascularized that by anastomosing those vessels to the internal mammary vessels in the chest.

This remarkable tour de force was carried out in 1946. Androsow

some ten years later published a series using that identical technique from Russia.

(slide) Our experience at Emory is similar to the one at Duke. We have experience with 21 such jejunal segments. These patients are compared with historical controls. The time in the hospital for a free jejunal segment combined with the tumor extirpative surgery is somewhere on the average of 12 days in comparison to the time for completion of similar reconstructive effort, using conventional deltopectoral flaps or other flaps, which varies from 65 to 112 days.

(slide) We too have had two fistulas. They have not been of any consequence and have closed, whereas, again, comparing them with skin-lined tubes of one sort or another, the fistula rate is considerably higher.

We have had two failures in the series of 21 patients. One was immediate and was clearly a technical failure. The other occurred at 2½ weeks in a diabetic who had some necrosis of an irradiated skin flap. Infection ensued resulting in eventual necessity of carotid ligation to control hemorrhage.

(slide) We have had no incidence of stenosis, and in skinlined tubes this is a well-known complication.

In closing, our observations parallel those at Duke. The transplanted segment clearly retains intrinsic motor activity. It also serves as an extraordinarily admirable way of reconstructing the cervical esophagus.

Have you had an opportunity in any of your studies to perform biopsies on the mucosa?

**DR. HIRAM C. POLK, JR. (Louisville, Kentucky):** I agree in general with the Duke group. I think they have touched some important bases about the utility of this procedure, and I would like to mention several of those.

First, Bob Acland in our group presented to the Head and Neck Society about two years ago reports of the first eight patients to undergo this procedure. Now more than 12 have been performed, and most of the points made here are critical to the success of the effort. I would like to speak of two or three of them specifically.

First of all, the cooling of the transplanted segment is absolutely essential. This is a long operation, and protection of that segment, whether it be colon or jejunum, as McGill showed about four years ago, is essential.

Second, the concept of the driving motor force for this detached reimplanted segment is correct. We studied this indirectly on one patient and showed that it clearly is unrelated to the esophagus. Now we are really looking for chances to see how this relates to jejunal feeding.

Third, this is a utilitarian and clinical procedure. It provides an additional measure of security for the person resecting in this area, and surely the security of reconstruction is pretty good.

In a procedure like this you have to be intensely careful in looking at your patients, because your real candidate is someone who can put up with a long period of anesthesia in this sort of operation as this reconstruction is accomplished in our unit.

**DR. J. ALEX HALLER, JR. (Baltimore, Maryland):** This is an impressive use of microvascular surgical techniques for implanting a segment of jejunum into the cervical esophagus in patients who are in an advanced age group. We have been interested in the replacement of the esophagus in children in the high thoracic area, and I would like to direct my thoughts for just a minute, and my comments, to this group of patients.

As you may know, they fall into two categories: One is the newborn infant with esophageal atresia, in which it may not be possible to get the two ends together; the other is the older infant who may have a destroyed esophagus as a result of caustic ingestion. Unfortunately, some of these microvascular techniques may not be applicable because of the small size of the vessels in these small patients.

In our laboratories during the last 18 months, we have had a

pediatric surgeon, Dr. Irene Oesch, from Berne, Switzerland, working with us. Of great interest is the fact that she has transplanted cat jejunum into the thoracic esophagus, attempting microvascular surgical techniques, but she noted that in some of the failures of the vascular anastomoses there was unexplained survival of some of the segments of the esophagus.

Looking further into this, we then transplanted 3 to 5 cm segments of cat jejunum without vascular anastomoses, removing the serosa and wrapping the graft with the paravertebral musculature. Dr. Oesch has completed eight of ten such procedures, with successful survival of the transplanted, truly free grafts, and they have peristalsis. To my disbelief, we have carried out some vascular injection studies that indicate that there is capillary ingrowth within about four to five days following implantation, making anastomoses into the intrinsic vasculature of these free jejunal segments.

Whether this is going to have any human application or not, we are not certain. I would remind you that these are short, 3 to 5 cm grafts, in cats. I would like to ask the authors, with that as a reference point, whether they have studied the vasculature of their transplanted segments. Is there the possibility that they are not necessarily vascularized by the anastomosis, but from surrounding tissue? If they have studied those vascular beds, I would be most interested in what they have found.

DR. W. C. MEYERS (Closing discussion): Dr. Ryan, I agree that your procedure does seem to be technically simpler than ours. We have abandoned the use of the Wookey procedure, to use another type of myocutaneous flap, because the Wookey procedure usually requires more than one stage, and often does not function well.

I assure you that our jejunal flaps do have better function than yours. Our patients can use both hands. They also do not require the use of a nasogastric tube, which was present on one of the slides.

Dr. Jurkiewicz, regarding the number of authors, the postoperative functional studies have required a cross section of interests, and for the benefit of the patient we have used all the facilities available.

(slide) This shows a jejunal biopsy of one of the patients, which was normal except for, perhaps, a minor degree of chronic inflammation.

Dr. Polk, our procedures do take a mean time of about six hours. The longest one has been about eight and one-half hours.

Dr. Haller, we have not had any experience in children. However, we have had the opportunity to re-explore one of these patients because she had some tracheal stenosis secondary to a large flap that had been used to cover her defect. She also had gained a massive amount of weight, so that whenever she lay supine the flaps closed over her trachea. There were pulsations within the vessels going to her transplanted jejunal segment.