Radical Transthoracic Forequarter Amputation *

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Operations previously used in the treatment of malignant disease of the upper extremity fail to cure patients who have invasive neoplastic disease in or in the region of the brachial plexus. The underlying thoracic wall and the adjacent subclavian vessels are usually involved so that removal of the structures of the shoulder girdle does not accomplish the primary goal of a radical operation for malignant disease. Furthermore, division and ligation of the subclavian vessels as they emerge from the thoracic cavity is often difficult and hazardous under such circumstances. One may well question whether or not a standard shoulder girdle amputation is more effective than simple disarticulation at the shoulder joint, in so far as the radical treatment of cancer is concerned. The authors belong to that group of surgeons who firmly believe that well-planned radical operations do cure some patients of malignant disease. Concern over the failure by a small margin to cure certain patients with local, slowly-growing but malignant lesions in this region has led to the development of the extended radical procedure herein described. A reasonably thorough survey of the literature on radical cancer surgery does not disclose any report of a similar operation.

Following the induction of anesthesia the patient is placed in the usual position for a posterolateral thoracotomy; however, the operative field is draped to include the entire chest and shoulder, the supraclavicular area and the side of the neck, so that the upper extremity can be moved freely within the sterile operative field. The first portion of the incision is made along and parallel to the medial border of the scapula. The fibers of the trapezius and rhomboid muscles are cut across and the scapula retracted away from the rib cage. The thorax is entered through the second interspace and the ribs spread. It is at this point that the operator can determine the operability of the lesion. The lung, pleura, and mediastinum are inspected and palpated. If metastatic lesions are found, the operator is not committed to a radical procedure and the wound can be closed.

In the absence of neoplastic involvement of intrathoracic structures, the next step is to identify, ligate, and divide the subclavian artery and vein within the chest. Exposure may be improved at this point by dividing the posterior ends of the first and second ribs. There is little difficulty identifying the subclavian vessels on the left side, but on the right side the operator must make certain that the subclavian and not the innominate vessel is ligated. Injury to the vagus and phrenic nerves is also to be avoided. If possible, the thyro-cervical and vertebral branches of the subclavian should be spared, but the costocervical and internal mammary branches are divided; this affords sufficient length of artery for secure ligation distal to the vertebral branch.

The third step is to complete the skin incision in such a way that the skin of the forequarter, together with the tumor, will be removable; the design previously se-

* Presented before the American Surgical Association, New York, N. Y., April 16-18, 1958.
lected for the purpose of closure must be held to, however. In one of our patients the breast appeared to be the most satisfactory tissue for use in closure. In the other patient this could not be done as the patient had previously had a radical mastectomy; a thick flap of skin and fascia was prepared from the scapular region and swung forward to cover. Following completion of the skin incision, the lower muscles are divided, including the latissimus dorsi, the serratus anterior, the pectoralis major and minor.

Next, the nerve roots are severed as close as possible to their emergence from the spine, including the fifth cervical to the second thoracic. No ligature is applied, but again, care is taken to preserve the phrenic nerve. At this point it is convenient to divide the remaining muscles (the levator scapulae, the sternocleidomastoid, and the scalenes). The incision in the second intercostal space is continued forward to the sternal border, the first and second costal cartilages are divided, and the clavicle is disarticulated from the sternum. This permits the removal of the forequarter en bloc with the upper portion of the thoracic cage.

The final step consists in bringing the previously prepared flap over the thoracic defect. The closure must be made airtight, and the lung should be expanded. A firm pressure dressing is applied to prevent paradoxical respiratory motion. We have
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Fig. 2. Completed transthoracic forequarter amputation.

Fig. 3. Method of preparing flap for closure when radical mastectomy has previously been performed.
not found it necessary to drain the chest or the wound.

The authors have performed this procedure twice. The first patient, B. E. #790647, a 51-year-old female, had had three previous unsuccessful surgical attempts at eradication of a fibrosarcoma arising near the outer end of the clavicle. The operation described was carried out on November 21, 1957. The second patient, R. M. B. #792536, a 43-year-old female, had had a radical mastectomy five years previously for carcinoma of the right breast. Her complaint at this time was rapid swelling of the right arm with severe pain and progressive paralysis. Careful study did not reveal any evidence of metastatic disease except in the region of the axillary vessels and brachial plexus. She was operated upon on December 6, 1957. In both, the postoperative course was un-
eventful. There was no difficulty with respiratory function. In the first patient the large breast sufficiently filled the defect so that there was almost no paradoxical motion. In the second patient, however, the defect, covered only by skin, bulged on coughing although no motion was apparent on quiet breathing. She left the hospital after two weeks, continuing to wear a pressure dressing. A prosthesis has been constructed for her which serves the dual purpose of preventing the defect from bulging and of permitting her to wear ordinary clothing without obvious deformity other than the absence of the arm. She does not wear the prosthesis at night when in bed.

We believe that occasional patients will present indications for this radical operation. It would appear to be advantageous for patients whose neoplastic disease involves the axillary vessels, the brachial plexus, or the soft or bony structures of the shoulder joint, when loss of the arm seems certain. Admittedly, it may be only a palliative measure. Many years must elapse before any statement can be made about a curative value.

There are other advantages of this extended method of forequarter amputation. One is that operability may be determined before the operator is committed to an amputation. Another advantage is the ease of controlling the main blood supply to the forequarter in the beginning of the procedure, so that there is added safety and early control of the feeding of neoplastic cells into the main circulation of the patient. There seems to be little difficulty in fitting a satisfactory prosthesis.

Summary

A radical operation which permits removal of the upper portion of the chest wall en bloc with the arm and shoulder girdle has been successfully carried out on two patients. The indications for this operation are malignant disease in the region of the axillary vessels, brachial plexus, or shoulder with obvious disability of the arm. The operation permits investigation of operability before commitment as well as more effective and safe control of the blood supply.
DISCUSSION

DR. DAVID W. RObINSON: Dr. Mulholland, Members and Guests: Although, as was stated, the usefulness of this procedure isn't very great, because the incidence of doing it won't be very often, when the operation is done, as has been done in two patients that have come to our attention, it is rather useful to enter the chest first, assess the situation, and then figure what coverage has to be done later on.

Both of these patients have been brought to my attention because of the coverage problem involved.

(Slide) The first patient, a woman in her late 50's, who had extensive radiation over a number of years for a fibro-sarcoma—she presented herself this way, with ulceration in the axilla and ulceration in the supraclavicular area. At that time, an operation was done very similar to the one done by Dr. Stafford and Dr. Williams, using essentially the same type of flap. Dr. C. A. Hardin put in a fiberglass prosthesis, which had to be removed, and this patient developed a complication, in contrast to Dr. Stafford's patient.

A rib resection was done, 5½ years have gone by, and the patient is very happy and well, wearing a prosthesis to fill out her dress.

The next patient is more complicated: This patient had received, as you see, massive radiation over the shoulder and over most of the chest wall. This patient was referred by my friend and colleague, Dr. Stanley Friesen, and we couldn't conceive of any decent coverage for this woman at all.

(Slide) So, the upper chest wall was simply left open, and, because the lung was adherent to the pleura, the patient had no real effusion.

After suitable preparation of granulation tissue (slide), we were able to get a primary skin graft to grow almost entirely, directly on the lung surface, which gave good coverage.

However, the patient did subsequently develop a recurrence on the sternum, which required a subsequent resection, and the patient only survived about 6 months from that time.

We think this is a useful procedure. Both were done, as I said, in the manner that Drs. Stafford and Williams employed in their operation, and we recommend it to you, should the occasion arise.

Thank you.

DR. RALPH F. BOWERS: Dr. Mulholland, it requires great courage for Dr. Stafford to present this subject. I have had some experience with quartectomy for malignant lesions of the extremities, and upon one occasion this radical quartectomy, and sometimes the comments about these operations border on the "unsocial."

In 1952 one of the boys with hopeless melanoma of the axilla was admitted to our hospital. He was a young man in his early 30's, who had a Handley procedure for melanoma of the chest wall 4 years previously. Now there are large involved axillary nodes, swelling and pain in the area, and fracture almost to the point that suicide was contemplated.

There were no other metastases, and we could not resist an attempt to help him. We embarked upon a procedure very much like Dr. Stafford has presented, except we used the anterior incision entering the thorax at the 3rd interspace.

When the pleural cavity was explored, we found, not too surprisingly, that the upper lobe of the right lung was attached to the thoracic apex with melanomatous involvement of lung, pleura, lymph nodes and possibly clavicle. We proceeded to resect the right upper lobe with the radical quartectomy.

(Slide) The arm is shown, with the lung at the thoracic apex and involved lymph nodes.

(Slide) This situation is very much the same as that shown by Dr. Robinson.

(Slide) This shows the patient 3 weeks postoperatively. A better removal of lymph nodes is certainly permitted by this procedure.

This patient lived 14 months following this operation, 9½ months without pain or significant difficulty. He was very hopeful, went home, had another baby, and made a little money by charging for a peek at the bizarre protrusion when his nose was blown.

He was very happy for 9½ months, and very unhappy in the last few months. Some people would not believe that the palliation was worth the effort.

DR. G. RAINEY WILLIAMS, JR. (closing): We should like to thank Dr. Robinson and Dr. Bowers for their discussion of this paper.

We were, of course, reasonably sure that other surgeons had performed this operation, and had hoped they would be here to record their results.

In answer to Dr. Robinson's point about using mesh to close the thoracic inlet, we had planned to use Tantalum mesh to prevent paradox. However, at the completion of this procedure, the most prominent thing in the inlet is the innominate vein, and we were reluctant to put the mesh against the innominate vein in both cases.

This is a relatively simple procedure technically, consisting of a thoracoplasty posteriorly, a Blalock procedure in the middle, and a radical mastectomy anteriorly.