Prosthetic Management of Hemicorporectomy

By

Bernard C. Simons, C.P. Justus F. Lehman, M.D.* Neal Taylor, M.D.** Barbara J. DeLateur, M.D.***

Director, Prosthetic-Orthotic Laboratory Instructor, Department of Physical Medicine and Rehabilitation School of Medicine University of Washington Seattle, Washington

* Professor and Chairman Department of Physical Medicine and Rehabilitation School of Medicine University of Washington Seattle, Washington

** Assistant and Senior Fellow Department of Physical Medicine and Rehabilitation School of Medicine University of Washington Seattle, Washington

*** Instructor Department of Physical Medicine and Rehabilitation School of Medicine University of Washington Seattle, Washington

Trans-lumbar amputation is the most revolutionary of all surgical procedures, severing the body in the low lumbar spine while preserving vital life functions. The procedure has been referred to as a hemicorporectomy. It was first conceived in 1947 for a female patient with far advanced cancer¹, but because of the physiological and psychological implications of such a procedure, it was not performed.

The first paracorporectomy was done in 1960^{1,2}. The patient expired

This project was supported in part by the Vocational Rehabilitation Administration Grant RT-3. shortly thereafter from pulmonary complications. Since then ten other patients that have undergone this procedure have been reported in the literature ³⁻⁹. Of these, four are presently living. All have been done for advanced cancer in a final life saving effort.

The surgical procedure is now very feasible. It can be done in two stages in a reasonable amount of time and with moderate hope of success. The amputation is usually between L4 and L5. The fecal stream is usually diverted to the abdomen through a colostomy, although an ileostomy has been used in one patient. The urine is diverted to an artificial bladder constructed from a section of a small bowel which opens on the abdomen. Collection devices must therefore be worn continuously.

The greatest remaining barrier has been rehabilitation so that the person whose life has been saved can return to meaningful living.

A most necessary part of this rehabilitation is a prosthesis that will allow mobility and provide functional support. A total lower body prosthesis presents major challenges to the prosthetic profession.

The ninth and eleventh reported cases of trans-lumbar amputation were done at the University of Washington Hospital on August 10, 1966 and November 14, 1966 respectively⁹.

Easton, et al¹⁰, from the University of Minnesota first described a prosthesis for patients with trans-lumbar amputation in 1964. This prosthesis was essentially open over the abdomen to allow access to the colostomy and ileal bladder collection devices. They demonstrated that a patient could be suspended in a prosthesis in an upright position with enough stability to allow wheelchair ambulation.

New York University has reported in a USPH Service film¹¹ results of two patients who were successively fitted with a prosthesis. Large openings were made in the plastic laminated socket to provide ventilation, reduce weight, and permit changing of ileal bladder and colostomy bags. A foam rubber lining one-half inch thick was used in the plastic socket to help distribute weight and avoid pressure necrosis. One patient was fitted with a total lower body prosthesis that enabled him to ambulate with a swing-through gait using Lofstrand crutches. He later progressed to stairs and curbs. This patient subsequently qualified himself to drive an automobile with hand controls.

In making prostheses for our two patients, no attempt was made to copy the prostheses made at Minnesota or New York University, other than to be aware of the general concepts they developed. The following criteria have been established in our laboratory for paracorporectomy prostheses:

- 1. Independent transfer in and out of the socket.
- 2. Maintenance of an upright position with sufficient stability to allow free use of upper extremities and wheelchair mobility.
- 3. A minimum eight-hour socket tolerance per day to be divided into two four-hour periods.

- Sufficient distribution of weight bearing surfaces to prevent pressure necrosis.
- 5. Allowance for adequate respiratory exchange.
- 6. Prevention of abdominal pain and nausea from continued pressure on abdominal contents.
- 7. Prevention of eversion of colostomy and ileal bladder stoma.
- 8. Easy access to colostomy and ileal bladder drainage bags.
- 9. Relief of pain and pressure over sternum and distal lumbar spine caused by leaning forward or backward in the socket.
- 10. Cosmetic appearance in both platform and walking prostheses.
- 11. Ease in cleaning areas of socket in body contact.

Fabrication of the prosthesis is accomplished by obtaining a plaster of Paris impression of the patient's trunk. A stockinette tube is sewn closed on one end, pulled onto the trunk and held in place under tension by use of elastic straps over the patient's shoulders. Patients can elevate the distal portion of the trunk while in the supine position. This allows adequate work area for applying the plaster of Paris bandages. Elastic plaster of Paris bandages are used to wrap the proximal portion of the trunk. The wrap begins at the level of the fourth intercostal space. It is continued distally in a figure of eight pattern. Considerable tension is applied to form the bandages well under the tenth costal cartilage as far posterior as possible (Figure 1). This proximal wrap tends to cause some distension of the abdominal area. Therefore, non-elastic plaster of Paris splints are applied distally to support the soft tissue. This prevents the complications of abdominal compression in the finished prosthesis, i.e., abdominal pain, nausea, decreased vital capacity, and eversion of colostomy and ileal bladder stoma.





FIGURE 1

FIGURE A

orthotics and prosthetics



The negative impression is filled with plaster of Paris and a mandrel provided for holding. The plaster of Paris positive is modified by building up with additional plaster at the end of the stump and paravertebrally to provide pressure relief at the distal end of the vertebral column and along the spines. Plastic lamination is accomplished using dacron felt, nylon stockinette and polyester resin. Best results were obtained by using an inner PVA bag and vacuum.

Our patients were provided with two prosthetic devices. A full prosthesis with free swinging hip joints, locked knee joints, and SACH FEET is used for forearm crutch ambulation. The anterior-posterior alignment is as described by F. Hampton¹². Medial-lateral alignment is accomplished

by placing hip joints on exactly the same plane and at 90° to the line of progression (Figure 4). The second prosthesis consists of a socket mounted on a platform in such a way as to allow the socket to rotate and in a position that provides for patient balance in both planes (Figure 3). Both of these prostheses are suspended by a shoulder harness.

One of our patients presented a unique problem with fecal drainage inasmuch as he had an ileostomy, rather than a colostomy, therefore a stoma was not present. The colon is normally evacuated only once per day so that an early morning enema can be given to a patient with a colostomy and no further drainage need occur until the following day. Because fecal contents in the small intestine are liquid in nature, continuous drainage is necessary to prevent intestinal obstruction. A direct opening over the stomal site provided access to the bag, but eversion of the bowel was found to occur with strenuous activities. To prevent eversion of the stoma and still allow free drainage of the fecal stream, a "mail slot" opening was developed in which the stoma was covered by the socket wall. thus preventing eversion of the bowel (Figure 5). A form-fitting slot was made two inches below the stomal site through which the bag could emerge from the socket, thus allowing easy access for drainage. Care must be taken to assure proper position of the slot so that the body weight does not occlude the bag. If the bag is occluded, a back pressure develops which can result in leakage around the point of attachment to the skin.

An adequate dry urine collection system is not only socially desirable, but an absolute medical necessity while in the socket to prevent maceration of the skin. A Lapides vesicotomy bag was originally used for urine collection from the ileal bladder. Because of the extreme flexible nature of this particular collecting device it was continually kinking, causing the glue seal to leak. An ileostomy bag was used for urine collection with a similar "mail slot" which proved very much superior to the Lapides collection device.

A semicircular notch was put in the front of the wheelchair platform to allow the patient to move forward on the chair and drain his collection bags into a toilet (*Figure 3*). This did not affect the stability of the platform.

Both patients have returned to their former employment. One is in the insurance field and the other in electronics repair. Our first patient has a remarkable socket tolerance (*Figure A*). Although advised to stay in the socket for only four hours at a time, he has on occasion been in the socket up to 12 hours a day with only a half hour break at lunch. By doing pushups while in the socket at least every 15 minutes, potential pressure necrosis problems have been avoided.

Our second patient has a limited respiratory capacity from chronic lung obstructive disease. His maximum socket tolerance has been 3 hours at a time with 1 hour break during noontime, thus normally spending a 6-hour working day in his prostheses.

REFERENCES

- 1. Kennedy, C. S., et al: Lumbar Amputation or Hemicorporectomy for Advanced Malignancy of the Lower Half of the Body. Surgery 48:357-365, 1960.
- 2. Patel, J. C.: Hemicorporectomy, Apropos of a New Surgical Technique, Lumbar Amputation of the Lower Half of the Body for Advanced Cancer. Presse Med 68:2346, Dec. 31, 1960.
- 3. Aust, J. B., Absolon, K. B.: A Successful Lumbrosacral Amputation, Hemicorporectomy. Surgery 52:756-759, 1962.
- 4. Yancey, A. G., Ryan, H. G., and Blasingame, J. R.: An Experience with Hemicorporectomy. J. Nat. Med. Assn. 52(4):323-325, 1964.
- 5. Miller, T. R., Mackenzie, A. R., Randall, H. T., and Tigner, S. P.: Hemicorporectomy. Surgery **59**:988-993, 1966.
- 6. Miller, T. R., et al: Translumbar Amputation for Carcinom of the Vagina. Arch. Surg. 93:502-6, Sept., 1966.
- 7. Mackenzie, A. R., et al: Translumbar Amputation for Advanced Leiomyosarcoma of the Prostate. J. Urol. 97:133-6, Jan., 1967.
- 8. Garbay, M.: Translumbar Amputation. Presse Med. 75:559-61, May 4, 1967.
- Wolfe, J. A., Winterscheid, L. C., "Supraradical Excision (Hemicorporectomy) for Genitourinary Carcinoma: A Brief Report." Presented at annual meeting of Western Section of American Urological Association, Inc., Honolulu, Hawaii, June 18-24, 1967.
- 10. Easton, J. R. M., et al, "Fitting of a Prosthesis on a Patient after Hemicorporectomy." Arch. Phys. Med., Vol. 44, June 6, 1963, pp. 335-337.
- 11. U. S. P. H. S. Film "Rehabilitation of the Hemicorporectomized Patient." Produced by the Institute of Physical Medicine and Rehabilitation, New York University Medical Center.
- 12. Hampton, F., "A Hemipelvectomy Prosthesis." Northwestern University Prosthetic Research Center, Chicago, Illinois. Feb., 1964.

ACKNOWLEDGMENT: The authors wish to acknowledge the cooperation and assistance of Mrs. Phyllis J. Wood, Medical Illustrator, School of Medicine, University of Washington.