SIMPLIFIED TECHNIC OF CONTINUOUS INTRAARTERIAL INFUSION FOR CHEMOTHERAPY OF THE HEAD AND NECK

ELDON R. DYKES, M.D.,* and ROBIN ANDERSON, M.D.

Department of Plastic Surgery

THE complications associated with continuous intraarterial infusion for chemotherapy of the head and neck have been of such magnitude as to approach the morbidity and mortality of the natural course of the disease for which the treatment is being given. This has precluded treatment for all patients except those whose condition is essentially hopeless. Many of these complications are referable to the unduly complicated technics associated with this method of therapy.

For example, in general, a major operative procedure using endotracheal anesthesia has been advocated to insert the cannula into the carotid artery. Endotracheal anesthesia alone is associated with risk. Complex technics have been used for suturing the cannula directly to the artery. Then, a mechanical pump or compressed gas usually is used to force the infusate into the artery. Operative intervention in the region of the carotid bifurcation increases the likelihood of cerebrovascular accidents and arterial hemorrhage. Direct suture of a cannula to the carotid artery carries the risk of possible avulsion of a portion of the artery if the cannula is inadvertently removed. The use of a continuous force to maintain the infusion is fraught with the ever-present danger of air embolus and drug overdosage. Air embolus is a possibility even when an airtrap is interposed between the machine and the patient. The expense of machines is another disadvantage. Any method of therapy that is so complex is certain to have a high morbidity and a significant mortality.

When continuous intraarterial infusion therapy for malignant lesions of the head and neck was first used at the Cleveland Clinic in 1960, the above-mentioned complex technics were followed. Complications were frequent and severe; they included air emboli, cerebrovascular accidents, drug overdosage, as well as minor complications. With increasing clinical experience, safer and simpler methods have evolved. The complications have decreased in number and severity. The purpose of this report is to present a simple and safe technic of continuous intraarterial infusion for chemotherapy of the head and neck.

Technic

Insertion of the cannula. Every effort is made to avoid direct operative intervention in the region of the carotid bifurcation. After local anesthesia has been administered, a polyethylene cannula is inserted into the carotid arterial tree. This is done either through the common carotid artery or in a retrograde fashion through the

**Formerly member of the staff of the Cleveland Clinic; present address: Straub Clinic, 1000 Ward Avenue, Honolulu, Hawaii.*

Downloaded from www.ccjm.org on July 19, 2025. For personal use only. All other uses require permission.

superficial temporal artery. If the superficial temporal artery is chosen, it is isolated just in front of the ear where it crosses the zygoma. If necessary, the vessel may be dilated with a probe before inserting the cannula. The superficial temporal artery route is especially useful when the entire neck is filled with tumor that prevents direct access to the carotid artery. Occasionally a tortuous artery prevents the insertion of the cannula to the desired position. If the common carotid artery route is chosen, a No. 18 gauge needle is placed percutaneously into the common carotid artery at the level of the thyroid cartilage. It is then advanced in a superiomedial direction into the external carotid artery. If the percutaneous entrance into the common carotid artery is below the thyroid cartilage, it may be necessary to use a spinal needle to reach the carotid bifurcation. A polyethylene cannula is inserted into the artery through the needle, and the needle is withdrawn over the cannula. If it is impossible to gain percutaneous entrance into the common carotid artery, a cutdown is performed on the common carotid artery and the cannula is inserted as described. After the needle has been withdrawn over the cannula, firm pressure is held for 10 minutes over the site of the needle puncture into the artery.

Position of the cannula. The location of the lesion to be treated determines the level to which the cannula is advanced. The position of the tip of the cannula usually can be accurately gauged by precise measurements taken before its insertion. The hyoid bone is used as a guide to the carotid bifurcation. Once the cannula has been advanced to the calculated level, its position is verified in one of two ways. Five milliliters of 50% Hypaque sodium is injected rapidly into the cannula, and an arteriogram is taken at the completion of the injection. A direct lateral view is best for viewing the external carotid system. Clinically the patient usually complains of facial pain when the injection is made into the external carotid artery; whereas there is no pain if the injection is into the internal carotid artery. *Figure 1* is an arteriogram of a patient with a far-advanced carcinoma of the nasopharynx. An alternate method of verifying the position of the cannula is by the injection of from 1 to 3 ml. of fluorescein succinate. The arterial distribution then fluoresces under a Wood's light. *Figure 2* illustrates this method on the same patient represented in *Figure 1*. The arteriogram delineates the exact position of the cannula more accurately than does the fluorescein method.

Fixation of the cannula. The cannula is fixed to the skin at the point of entrance through the skin. One-half-inch adhesive tape is wound tightly around the cannula over tincture of benzoin, leaving a small flange in the tape. A Dermalon suture is taken in the skin adjacent to the cannula. The suture is tied; then one limb of the suture is placed through the flange on the cannula and is tied again (*Fig. 3*). This firmly affixes the cannula, obviating the possibility of the cannula's becoming displaced. Cannulas have been maintained in position for as long as four months with this method.

Infusion. The infusion is maintained by gravity. The bottle of fluid is elevated until the hydrostatic pressure overcomes the mean arterial pressure. This distance

Downloaded from www.ccjm.org on July 19, 2025. For personal use only. All other uses require permission.

Fig. 1. Arteriogram of a patient in whom the catheter was inserted through the common carotid artery. The tumor was in the pharynx, in the region supplied by the internal maxillary artery.

in centimeters can be calculated by multiplying the mean arterial pressure in millimeters by 1.36 (the specific gravity of mercury is 13.55). For the average patient with a blood pressure of 150/90 mm. of Hg, the bottle of fluid must be approximately 180 cm. above the level of the artery that is being infused. With the aid of a Hi-lo bed, or by placing the patient on a mattress on the floor, patients with a systolic pressure of 200 mm. of Hg or more can be infused by gravity alone. A one-way flow valve is inserted into the hub of the arterial cannula. This prevents hemorrhage if the tubing should come apart.

Fifty milligrams of Methotrexate* is mixed in 1000 ml. of 5 percent dextrose in water or saline solution containing 50 mg. of heparin. This solution is infused over a 24-hour period (*Fig. 4*). For bilateral infusions, 25 mg. of Methotrexate in 500 ml. of solution is infused on each side per 24 hours. The speed of the infusion is inspected by a nurse hourly. Six milligrams of citrovorum factor is given intra-

**4-amino-N^{10}-methyl-pteroylglutamic acid, Lederle Laboratories.*

Downloaded from www.ccjm.org on July 19, 2025. For personal use only. All other uses require permission.

Fig. 2. Same patient as *Figure 1*. The injection of fluorescein into the catheter outlines the area into which the chemotherapeutic agent will be infused. Photographed under a Wood's light.

muscularly every 6 hours. The white blood cell count is determined daily, and is used as a guide to drug dosage; oral and intestinal ulcerations have not been a useful parameter of dosage. Treatment is continued until the white blood cell count decreases to approximately 3,500 per milliliter for patients with a normal, pretreatment white blood cell count. For those patients with a pretreatment leukocytosis, treatment is stopped when a significant decrease in the white blood cell count occurs. The decrease in white blood cells is usually not associated with a decrease in the red blood cell count. An antibiotic is given until the white blood cell count returns to normal. The infusion is repeated one week after the white blood cell count returns to normal. Additional infusions depend upon the clinical responses to the first two. Patients who have shown a favorable response are maintained on from 5 to 10 mg. of Methotrexate orally for four days each week indefinitely. A white blood cell count is obtained weekly and is used as a guide to therapy.

Between treatments, the cannula may be removed or left in place. If it is left in place, it is capped with a rubber cover, but the patient is instructed to inject 10 mg. of heparin daily.

Downloaded from www.ccjm.org on July 19, 2025. For personal use only. All other uses require permission.

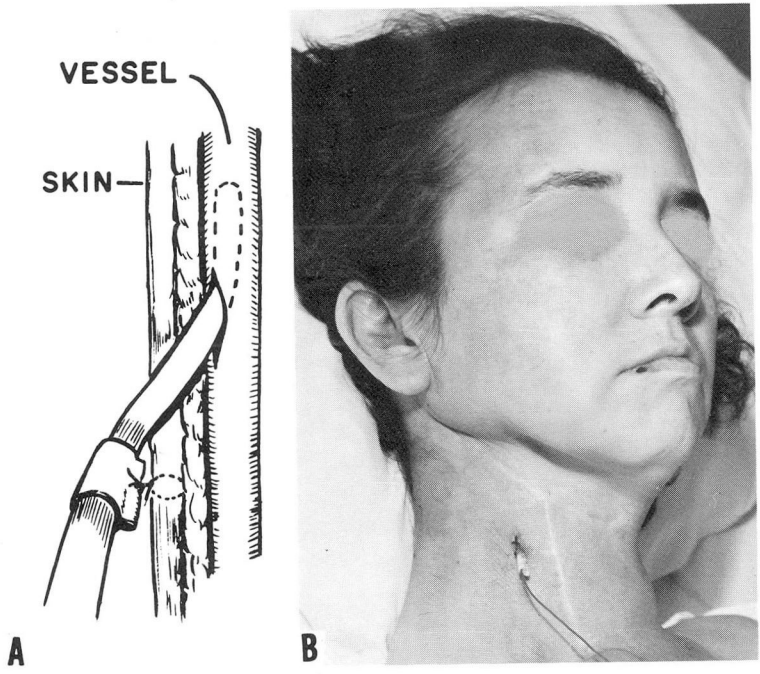

Fig. 3. A, Illustration of the technic for attaching the intraarterial catheter to the skin. B, The catheter in use; no dressings are necessary. The possibility of accidental removal of the catheter is practically eliminated.

Downloaded from www.ccjm.org on July 19, 2025. For personal use only. All other uses require permission.

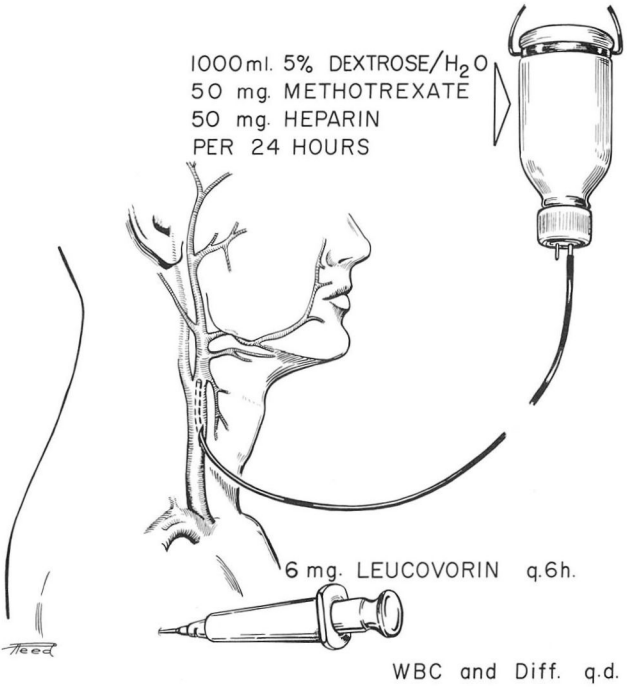

Fig. 4. Illustration of the technic for administering the metabolite-antimetabolite agents in the treatment of malignant lesions of the head and neck.

Summary

A simple technic of continuous intraarterial infusion for chemotherapy of the head and neck is presented. In our experience, this technic has been associated with a significant decrease in the morbidity and mortality associated with this method of therapy.

Downloaded from www.ccjm.org on July 19, 2025. For personal use only. All other uses require permission.