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Hydrotherapy Sleeve

DEVELOPMENT AND THERAPEUTIC ADAPTATIONS

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From the Henry Heywood Memorial Hospital, Gardner

Hydrotherapy is a recognized valuable form of adjunctive therapy used in the rehabilitation of patients having a wide range of medical problems. Yet the equipment in use today is not adaptable to the many changing circumstances of therapy; it lacks the mobility and flexibility needed for care of the bed-confined patient. Instead of accommodating the equipment to the patient, the reverse is true. If he cannot go to the physical therapy department, then hydrotherapy is denied him at a time in his illness when it may help facilitate his recovery. Thus, there is a need for a mobile, flexible hydrotherapy device which is designed for a variety of circumstances.

Accordingly, a device has been evolved that is uncomplicated in theory, application, and operation. With it, effective therapy is achieved, with an economy impossible with older equipment.

The hydrotherapy sleeve (Fig. 1) is a portable, flexible whirlpool bath. It can be easily applied to the part to be treated and operated by any person; no special technical skill is needed. It can provide a sterile environment if necessary or a variety

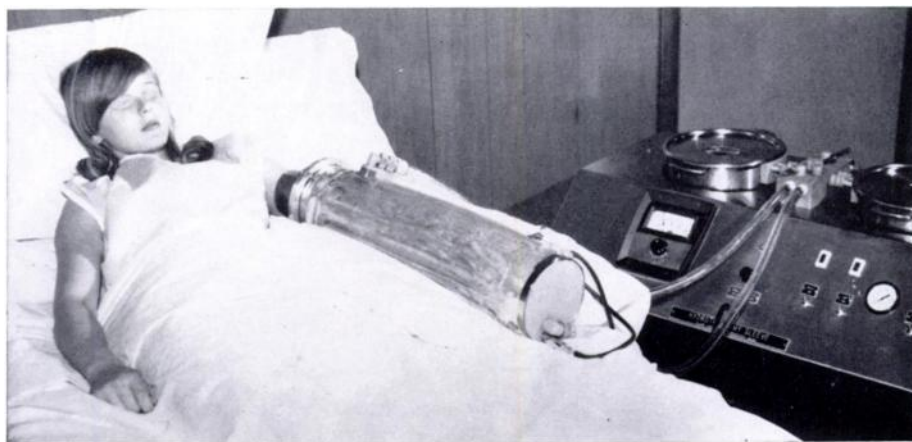


FIG. 1

The patient's upper extremity is being perfused as described in the text. The flow of perfusant from the warm or cold reservoir tanks is controlled by the manifold valve assembly that lies between them on the top of the cabinet.

of other objectives can be achieved. It consists of a water-tight perfusion chamber which is drawn over the part to be treated to allow circulation of medicinal solutions at a selected temperature and flow rate. The perfusion chamber consists of a cylindrical semirigid, heat-resistant, plastic material. Inflow and outflow tubing, appropriately connected, permit circulation of the perfusing solution from a reservoir. The chamber is molded to the contour of the extremity at the proximal and distal

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ends by means of a thin inverted elastic membrane, which forms a watertight seal. This membrane is reinforced by a fabric cuff which attaches to the extremity, fixing the sleeve in place and counteracting fluid pressure build-up in the chamber during perfusion.

The plastic material of the perfusion chamber is transparent permitting observation of the part during treatment, and it also is able to withstand heat sterilization without becoming deformed.

The reservoir (Fig. 1) consists of two removable tanks, each of twelve liter capacity, mounted in a cabinet. The liquid contents of these tanks are pumped through a system of valves and tubing, through the perfusion chamber. Variable volume control of the flow rate is achieved without significant pressure build-up in the perfusion chamber. The entire circulating and reservoir system can be easily disassembled and removed from the cabinet for cleaning or repair.

The temperature of the liquid contents of one reservoir tank is held at 15 degrees centigrade by controlled refrigeration, contacting the exterior of the tank. The temperature within the other tank may be maintained at 32 to 48 degrees centigrade by selective adjustment of a thermostatic regulator which controls the heating element in contact with the exterior of the tank. Thus, the temperature of the perfusing solution remains stable however long the duration of treatment. If control of temperature is not relevant to a particular treatment procedure, the perfusant may be circulated at room temperature from either tank.

Each tank is provided with a screen filter insert to remove particulate material returning from the perfusion chamber, thus clearing the perfusant prior to recirculation.

Air bubbles, which are essential to creation of air and liquid massage in whirlpool technique, are introduced by an air pump and passed through a multiperforated jet running longitudinally in the most dependent portion of the perfusion chamber.

Disinfection is accomplished by circulating hot water through the entire apparatus and sleeve in a closed system at 90 degrees centigrade for one hour. This is the method of cleansing deemed acceptable for portable hemodialysis equipment. Although absolute sterility is not attained in this manner, bacterial colony counts are kept at safe levels. The American Medical Association terms the process *disinfection* rather than *sterilization*.

The procedure for disinfection requires that the cuff on the sleeve be replaced with a metal cap, thus creating a closed system. An additional heat source is activated under the cold tank. Water is circulated at a maximum flow rate of forty-five liters per minute to maintain 90 degrees centigrade at all points in the system throughout the one hour cycle of sterilization. The cuff is autoclaved separately and replaces the metal cap when the equipment is placed in service to carry out a sterile procedure.

An alternate method of disinfection may combine steam autoclaving of the sleeve with the procedure described.

NOTE: The hydrotherapy sleeve was developed in cooperation with Clark Associates, Inc. of Worcester, Massachusetts.