Editorial

Saint Christopher to the Heart—Assisted Circulation

SOME OF THE ESSAYS that appear in the American Heart Association’s publication Modern Concepts of Cardiovascular Disease seem more timely and valuable than others, and in the former category is the paper in the current issue entitled, “Assisted Circulation,” by Cooper and Dempsey. In our opinion, this essay is both comprehensive and scientifically critical and presents the problems associated with the development of mechanical aids to increase the circulation of blood to the body with penetrating insight and commendable clarity. A supplemental source of information that we would recommend is Publication 1283—“Mechanical Devices to Assist the Failing Heart”—put out by the National Research Council.

While any rigidity in compartmentalization of problems should be avoided, those identified with mechanical hearts can be readily separated into four categories: (1) the mechanical, (2) the biochemical (and physical chemical), (3) the physiological, and (4) the psychological. Only the last category is omitted from the discussion of Cooper and Dempsey, which does not suffer significantly from the omission. This is not because of the lack of importance of psychological factors, but rather because of lack of scientific data, despite plethora of opinion, in this area.

In any well-designed scientific venture, phenomena will occur, which, appreciated by the alert mind, will lead to tangential and often serendipitous revelations and enlightenment regarding basic biological processes. For example, experiments with mechanical assistance devices are immediately concerned with how the normal circulation is regulated, the partitioning of peripheral flow, the auto-regulation of organic blood flow, and the requirements for, and effects of, pulsatile flow compared to pulseless flow.

The mechanical problems related to pumps, their size, and sources of power are largely alien to the physician’s engagement in the conquest or control of disease states; the physiochemical problems of the interactions of blood and pump, the interfaces of blood and foreign material, the destruction or alteration of the cellular elements of the blood, the denaturation of protein, and the disorders of coagulation may be just a fascinating limbo into which most physicians may only peer with awe; but the physiological problems will be more familiar, if not necessarily better understood, by the physician. For example, he will not be startled by the statement “insurance of normal net systemic flows does not insure normal partitioning of flow,” as he is accustomed to seeing, on the one hand, some patients with high output failure and, on the other, some patients who maintain a very limited but self-acceptable level of existence, with a very low cardiac output. The physician has been taught that an enlarged heart is a diseased heart and has observed that acute enlargement may sometimes surprisingly disappear and the heart return to normal size (for example, acute rheumatic carditis of decades past or a large arteriovenous fistula), but that a chronically enlarged heart may not be expected to do so (despite the remarkable regression toward normal in some patients who have had valve replacements). These clinical axioms may be translated into the scientific language of the essay which says: “Nevertheless it is equally clear that a heart stretched beyond a certain point by an acute load, or in the course of long standing valvular disease, may be incapable of resuming a favorable length-tension relationship.”

The review of current status and prospectus by Cooper and Dempsey of “assisted circula-
tion" deals primarily with application to temporary inadequacies of blood flow, with only implications to the greater problems of permanent mechanical assistance to the circulation, or the complete and permanent mechanical heart. However, the items discussed obviously have clear implications to this larger problem.

While the review focuses on the temporary assist to the failing myocardium, the clinician will be interested in other possible applications; viz., in some acute poisonings (for example, severe toxicity of digitalis), clusters of severe arrhythmias, some noncardiac shock states, and crises of pulmonary insufficiency, if accessory oxygenation might be added. To the repetitive heart-rending question of whether, and when, the patient on a circulatory assist could be weaned from it, the essay can give only the answer, "a trial of withdrawal is the only criterion by which therapeutic success can be judged."

The ingenious procedure of intra-aortic balloon pumping has an implied endorsement in the essay, but possibly the preliminary nature of the reports concerning its value in cardiogenic shock might have been emphasized more strongly.

Certainly the broad areas of our present ignorance are appropriately emphasized: experimental trials generally have been limited to healthy animals under general anesthesia, and quantitative measurements of benefit are currently as elusive as precise indications for patient selection and duration of treatment. Clinical experience to date has been meager, and when soberly considered, falls short of some expectations. Yet, the relatively crude and early state of this marriage of engineering and medicine suggests adequate potential to justify continuing the current levels of intense interest.

While the physician will be despondent if therapeutic failure results, as it must in many instances, he will have had some conditioning for his disappointments from his experiences with failures of patients to maintain themselves without assisted respiration, cardiac pacing, and, indeed, following operative intervention of any sort. Such experiences may permit some anticipation of the psychological problems to be faced in the future by both the physician and his patient.

Within the context of tradition, one might invoke mechanical Christophers to carry the heart through a hazardous period and be its protector (with its human inventor and operator) against accident and death. If one were church oriented, one could especially remember the problems of circulatory assists on either May 9 or July 25, the days Saint Christopher has been assigned in the Greek and the Roman church, respectively, as "his day," the humanist both days.

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References


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