The Treatment of Burns

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Preface

THE LITERATURE on burns is vast. To the clinician who is called upon to treat severe burns only rarely, it may prove more confusing than helpful. He may experience difficulty in choosing from among the many apparently authoritative but conflicting viewpoints. The chief purpose of this book is to furnish a guide for treatment in accordance with present day knowledge of burns. An ancillary purpose is to present information about certain practical details of management which are not discussed in scientific articles. These details often pose the most vexing problems in day to day patient care and, at times, apparently trivial aspects of therapy may spell the difference between death and survival. This book is not offered as an exhaustive treatise on burns. References to the literature are largely limited to particularly useful articles, but the text does take into account interpretation of information gained by various investigators throughout the world during the past two decades. Although the techniques presented have seemed preferable to us, it is recognized that different methods may be beneficial in the hands of others.

The burn wound evokes a systemic response reflected as a myriad of pathophysiologic processes. Proper care of the burned patient requires the integration of many aspects of therapy such as fluid balance, wound management, anesthesia, surgical technique, nutrition, treatment of infection, physiotherapy and psychotherapy. It is in the burned patient that the science and the art of medicine meet. Undue preoccupation with one or two facets at the expense of others may lead to disastrous consequences. It should be recognized that the discussion of burns under various chapter headings introduces divisions that are convenient for the purpose of presentation but are misleading so far as the physician's clinical approach is concerned. In the actual care of patients, many problems require simultaneous consideration.

For this reason, the book contains much purposeful repetition in addition to liberal cross references.

Because of the complexity of the problem, studies are more effectively carried out by a research team than by an individual. In 1949, the Surgical Research Unit of the Brooke Army Medical Center began to develop such a team for the treatment and investigation of burns. In the seven years that followed, more than one thousand burned patients were admitted for treatment and study to Ward 7 of the Brooke Army Hospital. The bulk of the material presented in this book is a synthesis of the knowledge that has been gained from this experience. Various surgeons and investigators were assigned to the laboratory and to the ward of the Surgical Research Unit for two-year periods. Each brought to the team a critical mind and knowledge from the disciplines of his past training. The intelligent skepticism of new clinicians provided a means of testing and retesting the validity of various concepts and techniques. This book outlines practices that have evolved from such an environment.

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We wish to thank the publishers of the following journals for their permission to reproduce various figures that have appeared in our previous articles: American Journal of Surgery; Annals of Surgery; Archives of Surgery; Journal of the American Medical Association; Journal of Clinical Investigation; Postgraduate Medicine; Surgery; Surgery, Gynecology and Obstetrics; and the J. B. Lippincott Company for figures in our chapter on Burns in their book *Surgery of Trauma* edited by Warner F. Bowers.

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CHAPTER 1

The Scope of the Burn Problem

THE TREATMENT of burns is a problem both in civilian surgical practice and in military medicine. The magnitude of this problem is not widely appreciated. It is the purpose of this chapter to convey a general view of various facets of the burn problem, to emphasize the needs of the present, to suggest a glimpse of the future, and to propose some partial solutions.

BURNS IN CIVILIAN PRACTICE

In 1954, 6,800 deaths occurred from burns in the United States.[8] It has been estimated that 10 to 15 burned patients require hospitalization for every burned patient who dies; thus, a conservative estimate would be that approximately 70,000 burned patients are hospitalized every year. According to Moyer's calculation, about 6,000 hospital beds are occupied the year round by burned patients.[7] The cost of burns in terms of human suffering and loss of social usefulness is inestimable.

Causes of Burns

Inquiries by various investigators about the causes of burns have yielded essentially similar conclusions.[3, 4, 7]

(1) At least half of all burning accidents could be prevented. There are some who believe that with the exercise of reasonable caution and the introduction of well-known safety measures, 70 to 80 per cent of all burns could be prevented.

(2) Open fires and unprotected heating units are responsible for an unusually large number of burns. This problem is of great importance in Great Britain and in the American Southwest where unprotected gas heating units are commonplace.

(3) Ignition of clothing is a frequent mode of burning, particularly in young girls whose skirts are readily ignited by contact with fire. In Bleck's analysis of 344 burned children, ignition of clothing caused the burn in 46 per cent.[1]

(4) The home rather than the workshop is the place where burns are most likely to occur. In Colebrook's series as well as in Moyer's, 70 per cent of all burning accidents occurred around the home.

(5) Children are commonly the victims in burning accidents. In Colebrook's experience, 70 per cent of all burned patients admitted to the hospital were children, those under the age of five being most often affected. In the United States the proportion of burned children is somewhat smaller, perhaps 30 to 50 per cent.

BURNS IN MILITARY MEDICINE

In warfare that does not involve the use of thermonuclear weapons, burns are rare in comparison with other forms of serious trauma. Burns due to flame throwers are liable to be fatal instantaneously. Phosphorus burns occur but not commonly. Vesicant gases, such as mustard gas, are a potential source of burns but they have not been used in recent wars.

Many burns in military medical practice occur as a result of plane crashes. Many of these injuries are fatal instantaneously. Deep burns of the exposed portions of the body—the face and hands—are common. If the clothes are ignited, very extensive and deep burns occur. In addition to these patients whose injuries are a result of the hazards of military life, there are many patients who are burned owing to simple carelessness in everyday activities, such as in the handling of gasoline and the use of field stoves.

Much of what has been written about the problems of burns in atomic warfare is now outdated by the developments of weapons whose devastating capacity far exceeds that of the bombs delivered to Hiroshima and Nagasaki. Information has not been released about the biologic effects of the newer weapons. There can be no doubt, however, that the problem of burns in thermonuclear warfare would assume proportions that stagger the imagination. Not even the experts claim to have any concrete conception of the magnitude of this potential problem or any realistic ideas about possible solutions. Anyone who has had experience in the concurrent management of as few as three seriously burned patients recognizes the overwhelming task of managing thousands or a hundred thousand burns. Since despair is the useless reaction to great problems, some fairly reasonable general approaches have been proposed from time to time (see Chapter 12).

TEACHING PROBLEMS

In general, there is no injury that is treated less expertly by the medical profession at large than a burn. This is tragic in view of the extraordinary degree of suffering, financial loss, and loss of social usefulness caused by the injudicious treatment of burns. Many patients with third-degree burns who could be healed within three or four weeks occupy hospital beds for months and even years. Some patients who could be quickly rehabilitated by energetic therapy develop avoidable deformities that prevent them from working; others are unnecessarily disfigured; and some actually die owing to neglect.

It is clear that the teaching of burn therapy is not adequate at any level of medical education. Although a senior medical student or an intern may not be expected to be expert in the art of skin grafting, he should be well grounded in the fundamental principles of therapy and capable of giving adequate emergency care. General practitioners, internists and pediatricians must learn that the limitations of their particular interests demand the skill of the general or the plastic surgeon for the management of a third-degree burn. Nonsurgical specialists may well treat second-degree burns but it is essential for them to recognize the characteristic features of the deeper injury. The sooner the surgeon can treat the patient with third-degree burns, the better for all concerned. Transfer of responsibility to the surgeon several months after injury results in waste of time, money, and energy, and in needless suffering.

Unfortunately, many well-trained surgeons may be incapable of properly managing a deep burn. Too often surgeons shy away from taking responsibility for the care of burned patients during the period of residency training. This is understandable, for the surgical resident is notoriously busy, and the treatment of only a single severely burned patient is an extremely time-consuming task. Other factors that steer the resident away from burns are the burned patient's reputation for ingratitude, most surgeons' preference for clean surgery, and lack of encouragement from senior attending surgeons. Some hospitals actually refuse to admit seriously burned patients. Hospital administrators apparently recognize that few patients can afford the expense of prolonged therapy and, therefore, that the hospital bill may never be paid.

There is an urgent need for improving the teaching of the therapy of burns. Responsibility for effecting an improvement lies principally in the hands of the professors of surgery who exert a dominant influence in medical school as well as in postgraduate education. Chiefs of surgical departments in hospitals not affiliated with universities must also share in this responsibility. Awareness of a problem is

commonly the first step towards its solution. The medical profession has demonstrated in the past that it is capable of prompt and effective action when it becomes cognizant of its deficiencies in certain respects.

IMPROVED ORGANIZATION FOR THE CARE OF BURNS

Burns may range from a very minor lesion to the most severe form of injury to which man is liable. Obviously, minor burns are easily managed, but the more severely burned patients require a specialized team of people for expert care. Thus, intelligent sorting is required: a patient having a minor burn may be treated as an outpatient, but the extensively burned patient should be referred to an institution where facilities and personnel are available for adequate management (see Chapter 2). There is an urgent need for the establishment of burn centers, both civilian and military. Burns, like other difficult medical problems (poliomyelitis, tuberculosis), are best treated in specialized institutions. Although the building, equipping, and staffing of such centers would be quite expensive, specialized institutions would afford the most economical and efficient method of managing severe burns. Like many other severe disabling diseases, burned patients should receive public support in order to allow for a diffusion of cost. There is a need for fund raising campaigns similar to those carried out for the study and treatment of acute poliomyelitis. State rehabilitation programs and crippled childrens' commissions should support the treatment of severe burns. The staffs of many hospitals and teaching centers have the knowledge for expert burn care, but ancillary help and organization is lacking because of the tremendous cost. Since a trained specialized team is not available, many costly compromises in therapy have to be made. One of the greatest needs is proper financial support and organization for expert care of the patient with third-degree burns.

THE CHANGING CHARACTER OF THE BURN PROBLEM

Physicians who have a special interest in the problem of burns are often approached with the question, "What is new in burns?" The inquirer usually expects to learn about some magic lotion, some miraculous dressing, or some foolproof formula. Such questions are prompted by the excessive emphasis of the professional and lay press on certain interesting but really unessential aspects of therapy. Fads and gadgets come and go without substantially altering the outlook for the burned patient. Nobody need fear that he is behind the times because he has not heard of the latest trick.

Progress in the treatment of burns has been slow but steady during the past 20 years. Improved understanding of certain physiopathologic

mechanisms quite naturally suggest new approaches in therapy. Studies in the early shifts of protein, water, and electrolytes have resulted in vastly improved management in the early postburn phase. Modern fluid therapy has decreased the mortality in moderate burns and prolonged the survival time in extensive burns. The extraordinary progress made in fluid therapy has created new problems, since patients who formerly died from fluid deficits now live long enough that their survival is threatened by other factors. Thus, the unusual situation has arisen where striking advances in one aspect of management appear to have created new problems.

The introduction of potent antibiotics has brought about a dramatic change in the importance of various types of infections in burns. Sepsis caused by Group A beta hemolytic streptococci which posed very great difficulties in the presulfonamide era, can now be combatted readily, but the invasive infection by other microorganisms has become an ever greater threat to the seriously burned patient.

The principles of therapy of third-degree burns have been well known for a long time: Eschars represent dead tissue; proper therapy demands removal of the dead tissue and its replacement by living tissue. Nothing could be more simple in principle yet more difficult in actual practice. Important changes have occurred in the attitude of surgeons toward the best methods of achieving the removal of eschar and important changes may be expected in the near future.

APPRAISAL OF PRESENT DAY PROBLEMS

Fluid Therapy

Despite differences in detail, several methods of management based on current understanding of fluid shifts have yielded good results. Startling departures from the now customary therapeutic approaches are not expected in the near future. However, much remains to be learned, both in respect to basic physiologic alterations and details of therapy.

Increasing emphasis may be expected on the problem of fluid therapy after 48 hours. In the past, it was assumed that fluid problems cease to exist when wound edema becomes maximal. The fallacy of this assumption has become evident in recent clinical experiences and experimental studies.[6]

Infection

The control of invasive infection is becoming an increasingly vexing problem in the therapy of burns. It is clear that even the potent antibiotics now available have failed to solve the problem. There is practically no information concerning the effect of burning on the

body's capacity to resist invasive infection. An extensive study of burns by immunochemical means is badly needed. The problems of infection are interwoven inseparably with those of eschar removal and homografting.

Removal of Eschars

Some progress has been made in the removal of eschars, but present methods remain far from ideal. Much has been learned about the extent of eschar that permits safe excision, technical aspects of excision, and proper timing. Severely burned patients often cannot tolerate the stress of an extensive excision and, at times, excision induces septicemia by an overwhelmingly large number of microorganisms. Enzymatic removal of eschars is still in the experimental stages.

Homografting

The clinical concepts and experiences in the use of homografts by Brown and his associates have proved most valuable.[2] Useful data are available on the indications for homografting, practical techniques for obtaining the grafts, storage of grafts, and the expected length of survival of the grafts. Unfortunately, the application of homografts depends on the prior removal of eschars, and the grafts often fail to survive for a sufficient period. The problem of homograft survival is of the utmost importance. It is being extensively studied by basic scientists throughout the world. A recent report on the apparently permanent survival of the skin homograft in a patient with agammaglobulinemia is of great interest because it strengthens the view that the failure of grafts to survive is related to an antibody-antigen reaction.[5]

If invasive infection could be prevented by the expeditious removal of eschars and if permanently surviving homografts could then be applied, survival of even the most severely burned patient would be conceivable.

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