Burn Care: A Specialty in Evolution—1985 Presidential Address, American Burn Association

J. WESLEY ALEXANDER, M.D., Sc.D.

Ever since man learned to use fires purposefully for cooking and warmth, thermal injuries have been commonplace and devastating. In the Ebers Papyrus, the first written documentation of medical practice, dating back almost 4,000 years, treatment of the burn wound is described rather extensively (3). It is not surprising that almost everything imaginable was used to cover the freshly burned surface in the centuries that followed. After all, infection was not understood until the late 19th century, and the subjects afflicted with burn injuries were willing to try anything to relieve the pain. Undoubtedly, physicians before 1900 realized that their prescribed treatments were relatively ineffective. Many of them contained ingredients which were almost impossible to obtain, suggesting that it was much easier for the physician to blame failure of treatment on the patient if he was unable to follow his precise orders. The salve of Paracelsus (10), for example, consisted of "the fat of very old, wild hogs and bears, heated half an hour in red wine and then dropped into cold water, which was next skimmed and the fat rubbed up with roasted angleworms and moss from the skull of a person hung, scraped off during the increase of the moon, to which was added bloodstone, the dried brain of a wild hog, red sandalwood, and a portion of a genuine mummy." Most of the topical medicines for burn injury during the period before the 20th century contained fats and/or proteinaceous material such as eggs. These undoubtedly often had a soothing effect by preventing dehydration and perhaps favoring the formation of a pseudo eschar. However, many of the concoctions also used additions of fecal material from a variety of animals or birds to provide a degree of mysticism.

The incidence of burn injuries increased considerably after the introduction of gunpowder for human pleasure and destruction. While occasional treatises and reports on the care of burns preceded him, William Clowes (4) published a book in 1596 which was devoted primarily to the subject of burns (Fig. 1). A surprisingly large number of monographs and books followed during the ensuing three centuries. Not all topical treatments of burns were bad. Rhazes (850-923) advocated cooling the wound (16); this method of treatment was again popularized by Sir James Earle in 1799. During the 19th century, oil of turpentine, alcohol, and phenol were noted to have effects on limiting supplicative processes in traumatic and surgical wounds and were tried for topical therapy of burns. There were indeed occasional reports of improved healing and less suppuration. However, these treatments ultimately proved to be toxic to tissues (5). Likewise, Carron oil was popularized in England, which consisted of linewatér and linseed oil in equal parts.

The systemic treatment of burns before the 20th century was equally unsatisfactory and consisted primarily of the two major treatments for almost everything else, i.e., purging and bloodletting. Although empirical, these two treatments do stimulate nonspecific immunologic responses and undoubtedly helped some conditions. Even the prominent Hermann Boerhaave, of Leyden (1668–1738), ordered phlebotomy and purging for himself when he received a substantial second-degree burn on his face and arms (5).

Thus, before the last half of the 19th century, the treatment of burns, like almost every other medical condition, had little scientific basis and consisted primarily of purging and bleeding the patient and placing on his wounds substances which either promoted infection or were toxic. In addition, skin grafts for the treatment of burns were not yet developed. It is not surprising, therefore, that the results of burn therapy were not particularly good. All patients with substantial full-thickness burns died.

The explosion of scientific knowledge in the late 1800’s considerably affected burn care. From autopsy studies, Tappeiner (1881) recognized the hemoconcentration associated with burn injury (14). These studies, and those of Baraduc (1862) (1), led to the development of saline infusions for the treatment of burns by Tommasoli in 1897 (17) and Parascandolo in 1901 (11). Another innovation of this time was the treatment of the burn wound...
A PROFITABLE AND NECESSARIE
Booke of Observations, for all those that are burned with
the flame of Gun powder, &c. and also for curing of
wounds made with Musket and Caluter flout, and other
weapons of war commonly vied at this day both
by sea and land, as hereafter shall
bedeclared:

With an addition of most approved remedies,
gathered for the good and comfort of many,
out of divers learned men both old
and new Writers:

Last of all is adjoined a short Treatise, for the cure of
Lara Uncord, by suction and other approved waises
of curing, heerofore by me collected, and
now againe newly corrected and
augmented in the yeare
of our Lorde
1596.

By WILLIAM CLOWES
one of his Maiesties
Chirurgeons.

Imprinted at London by Edm. Bollifant,
for Thomas Dawson.
1596

Fig. 1. Frontpiece of the book of burns, by William Clowes (taken from Reference 4) (Reprinted with permission).

by exposure. Copeland (1887) first described the expo-
sure method (6), and it was subsequently used success-
fully by several physicians including Bernhard (1904),
Snevve (1905), and John (1910) (16). The technique was
resurrected by Alastair Wallace in 1947, in Edinburgh,
and is still being used, although it is inappropriate to do
so in a modern hospital setting. The third major advance
of this period came from the grafting of skin to the
wound, since before this time all third-degree wounds
healed by contraction (sometimes with a persistent ulcer)
or resulted in the death of the patient. Reverdin (13)
described a technique for performing small freehand
grafts in 1872. These small grafts subsequently came to
be known as ‘pinch’ grafts, and were used in the treat-
ment of burns on a regular basis until only recently. In
1874, Thiersch (15) used larger pieces of skin taken
freehand. However, since few surgeons were skilled in
the use of a Thiersch knife, the majority of grafting was
done with small pieces of skin. In 1939, Padgett de-
veloped his dermatome, which made skin grafting much
easier. Subsequent development of the Brown derma-
tome and later the Tanner skin mesher, and their sub-
sequent derivatives, have now made skin grafting an easy
accomplishment.

Thus, during the period from about 1890 to 1940, the
major advances in burn care consisted of fluid therapy
during the early management rather than bleeding and
purgation, the exposure method which, at that time,
provided better prevention of the suppurative process of
the burn wound, and the grafting of skin to cover full-
thickness injuries.

MODERN BURN THERAPY

World War II did much to focus attention on the need
for improvements in the care of the thermally injured.
Intravenous fluid therapy was well established by this
time, as well as hemotheraphy, which became a practical
reality between World Wars I and II. Extensive research
showed the presence of excessive fluid shifts into the
extravascular spaces, and several formulas were devel-
oped which were subsequently improved to provide ade-
quate resuscitation of most patients. Perhaps of equal
importance was the introduction of penicillin therapy in
the early 1940’s, and the subsequent proliferation of
antibiotics and antimicrobial agents. In this regard, nu-
merous antibiotic and antimicrobial agents were applied
topically, but it was not until 1964 that these were
actually clinically successful, with the simultaneous
development of 0.5% silver nitrate compresses by Carl
Moyer, and sulfamylon cream by the U.S. Army Surgical
Research Unit.

After the problems of major resuscitation and topical
therapy were largely solved, numerous patients with
larger burns were living for longer periods of time, only
to die of infection. It was finally realized in the late
1960’s that malnutrition was the major underlying con-
tributing factor in many burned patients, and intensive
efforts at nutritional support of these patients were in-
stituted. It is now recognized that the major portions of
the immunologic abnormalities and predisposition to
infection in burned patients are related to nutrition.
Even the hypermetabolic response of the seriously
burned patient seems to be influenced by early nutri-
tional therapy. Early excision is another major advance,
which has allowed reduction in hospital stay and perhaps
improvement in survival. These advances have led to
progressive improvements in survival of the burned pa-
tient (Fig. 2). The development of artificial and cultured
skins is currently at the forefront of methods of skin
closure, as is the potential use of treated allogeneic skin
for permanent closure. It is hoped that these techniques
will result in a decreased need for a donor site, as well as potential improvements in cosmetic results.

**CONTRIBUTIONS OF BURNED PATIENTS TO HEALTH CARE**

Investigations in the field of burn research have aided greatly in improved care of patients who are not thermally injured. These advances include the development of skin grafting techniques, plastic surgical procedures for the reconstruction of defects from other types of trauma and congenital abnormalities, better treatment of shock, better methods for control of infection, better understanding of the resistance mechanisms to microbial infections in immunocompromised hosts, better understanding of the nutritional needs of hypermetabolic and/or septic patients, a better understanding of inflammatory mediators and techniques for their regulation, and improved knowledge of the control of scar formation, to name only a few.

**PRESENT OUTLOOK IN BURN CARE**

At the present time it is possible to obtain survival of patients with massive thermal injuries. In good-risk patients below the age of 40 years, it is not unusual to have survival following burns involving 90% or more of the total body surface area, and there are now numerous patients who have survived burns of greater than 75% full-thickness injury. With the development of skin expansion techniques, skin substitutes, epidermal grafting techniques, and allogeneic skin grafting, it is my opinion that it will be possible to achieve survival in almost any burned patient who is otherwise healthy, does not have pulmonary injury, and is not at an exceptional risk because of age. Total permanent grafting of the patient with allogeneic skin will soon become a reality. I predict that, as an expansion of ongoing research, it will be possible to control or prevent hypermetabolism in burned patients, and to use nutritional and immunomodulator therapies to effectively prevent the majority of infections. The problem of inhalation injuries will be more difficult to solve.

**NEW CHALLENGES**

Largely through the efforts of safety-oriented groups, including the Fire and Burn Safety Alliance and the American Burn Association itself, the incidence and severity of burn injuries should continue to fall during the next few decades (Fig. 3). The mortality from burn injury in the United States in 1980 (last figures available) (8) was only 2.7/100,000 population, the lowest in history and only one third of the incidence 75 years ago. However, the number of deaths from burns has remained relatively constant, largely as a result of an overall increase in total population (Fig. 4). Brigham and Wilcove

Fig. 4. Deaths caused by burns in the United States, 1900–1980 (taken from Reference 8).

(2) have recently shown a 9% decrease in hospitalization for burn injury in Pennsylvania during the last 5 years, as well as a decrease in burn size.

It is apparent that both the incidence and severity of burn injuries will continue to fall in the United States as a result of intensified prevention and safety programs. For example, there was a 2% reduction in 1984 compared to 1983. Achievement of this goal is certainly welcomed by every member of the A.B.A. However, it does mean that in the near future there will be a continued fall in
the census of many burn units, now numbering 139 in the United States. I am not so concerned about the change in the quality of care that may result, but more about the dilution of subjects available for clinical research purposes, since I feel that research using burned patients can continue to make major contributions to the care of burned and nonburned patients far into the future. It is my recommendation that every effort should be made to concentrate the care of burned patients, not only to optimize care but, perhaps more important, to improve research potential. Basil Pruitt and others have previously emphasized that the burned patient is the universal trauma model (12), and lessons learned from burned patients are freely applicable to trauma in general, as well as to a variety of other diseases. Areas of burn research which I feel will pay handsome dividends are nutrition, control of infection through the use of immunomodulators, wound management techniques, regulation of scar formation and wound healing, and treatment of inhalation injuries. It does not seem unreasonable that all major burns in the United States be treated at specialized care facilities devoted solely to the care of burned patients. Facilities with less than 100 admissions per year should consider consolidation with other burn facilities. This may in some cases provide an inconvenience, and in others generate a perceived loss of prestige. However, these factors are clearly outweighed by the potential benefit to mankind, and to the individual patient.

Despite a projected decrease in the incidence of severe burn injuries, I feel that there is a striking need for increased allotment of research funds for clinical and laboratory studies related to burn injury. I am alarmed at the present administration's efforts to decrease the number of research grants in the medical sciences (from 6,526 to 5,000 for this fiscal year). This may have particular impact, since the administration of the National Institute of General and Medical Sciences (N.I.G.M.S.) does not seem to place clinically related studies of burns and/or trauma as a leading priority. Since burn- and trauma-related research are funded primarily through the N.I.G.M.S., this means research dollars for thermal injury are particularly competitive. P. William Curreri (7) has previously emphasized that the burn community should look to other sources for funding of burn research. While I agree with Doctor Curreri, I strongly believe that the A.B.A. should become intensely involved with federal issues, including research funds that involve the management of current and future burned patients in this country.

WHAT CAN THE A.B.A. DO?

What I have hoped to do in this brief presentation is to provide an overview of where burn therapy has been, is now, and will be in the next two decades. It is obvious that there is a continuing evolution, not only in the provision of burn care, but in the societal needs and individual needs related to postburn rehabilitation.

An ever-increasing emphasis on safety and prevention of burn injury will be of benefit to us all. It is appropriate that the American Burn Association become increasingly involved with a variety of agencies to implement legislation which will prevent thermal injuries. The A.B.A. has been instrumental in the passage of the Cigarette Safety Act and other safety-related legislation. We should expand involvement with groups such as the Fire and Burn Safety Alliance, increasing our ability to implement safety and burn prevention measures.

There should be intensified emphasis on rehabilitation and reconstruction. More patients with larger and often more disfiguring and disabling burns are surviving massive thermal injury. Some of these patients do well; many others do not. Return of these individuals to productive positions in society can be extremely challenging. Research should be intensified in psychosocial rehabilitation as well as occupational rehabilitation. Substantial advancements are being made in reconstructive surgery and control of wound healing which will be of great benefit to survivors of burn injury. To emphasize the importance of rehabilitation, I have appointed Roger Salisbury as chairman of an ad hoc Committee on Rehabilitation. I hope that the A.B.A. will strengthen this important new committee and perhaps someday soon evaluate it to a standing committee.

The American Burn Association needs to take the lead of other major organizations, such as the American Society for Transplant Surgeons (A.S.T.S.), and become deeply involved in legislative issues related to burn care. The A.S.T.S. has aided greatly in passage of a new organ transplant act, and the A.B.A. could play a similar leadership role, if apathy can be overcome. Our organization can no longer take a passive role in the numerous issues relating to federal regulations and legislation that affect burn care. Our involvement should not be a personal one, but must be directed toward eventual benefit of the patients for whom we are responsible. To this end, I have appointed Alan Dimick, a past president of the A.B.A., to be chairman of an ad hoc Committee for Federal Issues, whose primary purpose will be to examine how the A.B.A. can become a resource for legislators who would like to have or need relevant information related to our laws which affect the care of burned patients. We must also find ways in which the burn community can improve our status for obtaining research funds from the National Institutes of Health, related to burn problems.

Additional sources of research funds outside the N.I.H. should be sought because of the enormous impact these research programs have, not only on care of burned patients, but on many other patients as well. Our association with the National Firefighters' Association has been most encouraging, and I hope that the A.B.A. can continue to work in concert with this group and become increasingly productive in the future.
Finally, I would urge more regionalization of burn care facilities. The contributions of facilities which have aggressive, ongoing research as well as superb clinical care are exemplified by the three Shriners Burns Institutes and the U.S. Army Institute for Surgical Research, as was so well emphasized by our former president, Carter Nance (9). These exemplary units have made major contributions to patient care because their patients have entered into clinical research studies which can provide important answers to difficult questions in a relatively short period of time. Some of these questions require relatively large numbers of patients, and may never be answered if the clinical material is diluted too thinly among small burn units. Provincialism, pride, and personal gain should take a back seat to advancement in this sentinel specialty.

Nothing is static. The A.B.A. has become increasingly complex during its relatively short existence and has had the flexibility to meet new challenges. These challenges are now bigger and more complex than ever before. I am confident that our Association will be able to adapt and expand, and that its leadership in health care will be increasingly apparent.

REFERENCES