

History of Burns: A Review

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Abstract

Burn Injuries represent one of the most important public health problems faced by both developing as well as industrialized nations today. This review article highlights the history of burns in both the developed and developing countries especially pertaining to Indian Scenario.

Keywords: History; Burns; Review.

INTRODUCTION

Burn Injuries represent one of the most important public health problems faced by both developing as well as industrialized nations today. Burn Injuries may be intentional or unintentional but intent is sometimes difficult to determine. Burns or thermal injuries occur when hot liquids (scalds), hot solids (contact burns) or flames (flame burns) destroy some or all of the different layers of cells which form the human skin and even deeper tissues. For traditional reasons, skin injuries due to

ultraviolet radiations or radioactivity, electricity and chemicals, as well as respiratory insults resulting from smoke inhalation, are considered as fire/burn injuries. Burns represent an extremely stressful experience for both the burn victims as well as their families.

An extensive burn profoundly affects the patient's physique, psyche, financial situation and family. Patients suffering from extensive burn injuries frequently die while others suffer from painful and prolonged physical recovery. In different communities and countries, the etiological factors responsible for burn injuries vary considerably, hence a careful analysis of the epidemiological factors in different places is needed before the planning and implementation of a sound prevention program. This review article highlights the history of burns in both the developed and developing countries especially pertaining to Indian Scenario.^{1,2}

History of Burns

Those who fail to read history are destined to suffer the repetition of its mistakes. "You have to learn what others have done because you won't live long enough to make all the mistakes

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yourself". Burn trauma is as old as the discovery of fire in the history of man kind. Medicine is built on the best of the past. Thus, a study of 'History of Burns' contributes to a review of accomplishments and errors, false theories and misinformation and mistaken interpretations. The history of burns, especially in India, is very fascinating. It teaches us where we started from, where we stand today, in what direction we are marching and guides us for the future.

History of Burns in the Ancient Ages

World History

The philosopher Santayana said; "Those who cannot remember the past are condemned to repeat it". In an address to the Royal College of Surgeons,

Churchill remarked; "The longer you look back, the further you can look forward". In considering the history of the treatment of burn injuries, one might quote Adam MacDougall, who in 1819 stated that "It would equally exceed the bounds of convenience and utility to particularize all the remedies that have been recommended in the treatment of accidents of this kind". Hippocrates (430 BC) used swine's semen, resin, bitumen and Oak bark solutions in the treatment of burns. Chinese (600-500 BC) used extracts of tea leaves. Smith papyrus (1500 BC Egyptians) used gum and goat's milk mixed with mother's milk and strips soaked in oil. Celsius (ancient Rome) advocated honey and bran. Glen (ancient Rome) described vinegar or wine in the treatment of burns¹⁻³ (Table 1.1).

Table 1.1: Burn treatment history

<i>Neanderthal man</i>	<i>Extracts of plants</i>
Smith papyrus (1500 BC, Egyptians)	Gum and goat's milk mixed with mother's milk
Chinese (600-500 BC)	Extracts of tea leaves
Hippocrates (430 BC)	Swine's semen, resin and bitumen Oak bark solutions
Celsius (ancient Rome)	Honey and bran
Rhases (9th century)	Cold water
Pare (1517-1596)	Excision and ointments
David Cleghorn (1792)	Vinegar and chalk poultice
Edward Kentish (1797)	Pressure dressings
Syme (1827)	Wool dressings
Lisfranc (1835)	Calcium chloride dressings
Passavant (1858)	Saline baths
Joseph Lister (1875)	Boric acid and Carbolic acid
Tomasalis (1897)	Salt water injections
Wallace (1949)	Exposure treatment
Keswani MH (1984, India)	Boiled potato peel (BPP) bandage

Indian History

Fire injuries in India have been common right from the ancient times. Suicide by fire out of insult

was one of the common reasons. In Shiva Purana, it is mentioned that Lord Shiva's consort Sati had jumped into the sacred fire after being insulted by her father Daksha. Another reason for suicide by fire

was 'Sati Pratha' a common tradition of committing suicide by widows. It is well known that Plastic Surgery originated in India in the Vedic Period about 3500 BC. Among the many distinguished names in Hindu medicine, that of Sushruta, the 'Father of Ancient Plastic Surgery' stands out in prominence. Sushruta was the son of the sage Vishwamitra, contemporary of Rama of Ramayana. He compiled the surgical knowledge of his time in his classic 'Sushruta Samhita'. It is believed that this classic was compiled between 800 BC and 400 AD. Sushruta was the first to classify burns into four degrees: Singeing, Blister, Superficial and Deep Burns.¹⁻³

History of Burns in the Middle Ages

World History

The British at the Battle of Crecy in 1346 were the first to use gun powder and this development gave rise to many medical problems including those associated with the treatment of burns. The stimulus of the war experience initiated new and experimental types of treatment. In 1596, Clowes wrote a treatise on gun powder burns. He did not differentiate the depth of burns but rather described multiple types of treatment on different part of the body. He suggested oily dressings containing many drugs, did not open the blisters and was an advocate of bleeding. Ambroise Pare (1517-1596) described about excision and ointments. Fabricus Hildanus (1610), who wrote *De Combustioni Tus*, was the first to classify burns into three categories and also showed pictorially the early successful surgical release of hand contractures. Pare clearly described the differences between second and third degree burns that frequently developed contractures. Richard Wiseman in 1676 wrote several "chirurgical treatise" and discussed splinting to avoid contractures. He advised refrigerants or calefactive medicaments. Kentish (1797) described pressure dressings as a relief for pain and in his essay on burns promised to "rescue the healing art from empiricism and to reduce it to established laws". David Cleghorn (1792) used vinegar and chalk poultice for burns treatment. The use of ice and ice water for analgesia and the prevention of edema was explained by H Earle (1799) in his essay "the means of lessening the effects of fire on the human body". Syme (1827) used wool dressings. Lisfranc (1835) described calcium chloride dressings. In 1823 the Edinburgh Medical Journal published two papers on postmortem finding in two burn deaths. One patient had a gastric ulcer and another gastric congestion. Multiple lectures at this time were describing perforation of the stomach following burn deaths and there was increased interest in

studying both the pathology and treatment of thermal injuries. Cotton dressing over burns was first discussed in a Glasgow Medical Journal in 1928. Readers were told how to apply dressing and were cautioned against changing them more than once daily. Dupuytren (1832), the brilliant French surgeon, made multiple contributions to burn research, including the documentation of the degree of injury to depth and the description of the phases of the post-burns course irritations inflammation, suppuration, and exhaustion. Sir George Ballingall in 1833 gave one of the best description of death from burn sepsis; "sinking in a hectic state, exhausted by a profuse discharge of matter from an extensive separating surface". In a landmark decision in 1848, the managers of the Royal Infirmary in Edinburgh designated one building for all burn cases and this became known as the burns hospital. Passavant (1858) gave concept of saline baths. In 1875 Joseph Lister recommended boric acid and carbolic acid for burn wounds in order to kill bacteria. In 1881 Tappeiner of Munich studied autopsies of burn deaths and recognized the concentration of blood, increased hemoglobin concentration and decreased blood and water volume. The appreciation by Tappeiner of burn pathology was a significant event. Thomasalis (1897) described use of salt water injection.¹⁻³

Indian History

The history of burns in India in medieval period is that of decline in India and lull in European countries. The natural feeling of fear for operations grew and love for medicines increased. The governments prohibited and neglected the practice of surgery. The famous Buddhist scripture Mahavagga Jatak enjoined strict prohibition of surgery and extended the terror of hell both for the surgeon and the patient. 'Manusmriti' prescribed special rituals by way of purifications of surgeons, who were looked down upon as unclean. Later during the Rajput, Muslim and Maratha periods, Ayurvedic (Hindu) and Unani (Arabic) systems of medicine were practiced by Vaidis and Hakims respectively. The Vaidis were purely physicians and the practice of surgery was restricted only to incision of abscess, dressing of wounds and treatment of bone and joint injuries by barbers and bone-setters. Not much information is available in literature related to burn injuries.¹⁻³

History of Burns in the Modern Age

World History

In 1905, Sneve noted the importance of intravenous saline for resuscitation and wrote

an article in the Journal of the American Medical Association advocating early skin grafting. The understanding of burn pathology took a great leap forward when Underhill (1930) studied a group of patients burned in a theater fire in 1921. He analyzed the content of blister fluid and determined that burn shock was due to fluid loss and not toxins (a popular theory of that time). The Coconut Grove Fire in Boston in 1942 resulted in extensive studies by Cope and Moore on the diagnosis and treatment of burn shock. Controversies over the best method to treat the burn wound persist to the present day. Dressings remained popular until Wallace in 1949 advocated exposure treatment for burns of the face, buttock and perineum. Formulas gradually evolved to calculate fluid losses. Evans (1952) used burn skin surface area and weight as the principal variable. The Brooke formula was a modification of the Evans formula and utilized salt, colloid and water. Moyer and Associates (1965) recommended only Ringer's lactate solution, yielding alert, oriented patients even when the body surface area burn was large. The pattern of triage of burn patients changed dramatically in the 1960's. The US Army Research Unit was initially guided by Pulaski and Artz, who stressed patient care as well as clinical and laboratory burn related research. Critically injured patients, civilian and military, were referred to the center and the concept of the multidisciplinary burn team evolved. The major mile stone in topical burn therapy was the application of solutions of silver compounds or salts, which played an important role in reducing the rate of burn wound sepsis and mortality. Silver sulfadiazine was developed by Charles Fox in the 1960's and has become the mainstay of topical antimicrobial therapy due to its success in controlling infection and minimal side effect profile. Mafenide acetate (Sulfamylon) briefly was a viable alternative to the use of silver compound solutions in the treatment of infections but due to its carbonic anhydrase inhibitory effects which can lead to systemic acidosis, its use was all but discontinued except in cases of treatment of invasive wound infections. The other common silver-based therapy was silver nitrate, described by Moyer *et al.* in 1965. Silver based topical treatments were successful in controlling infections especially *Pseudomonas aeruginosa* infections.⁴ In 1962 the Shriners fraternal organization in the United States began development of three burn centers affiliated with universities and dedicated specifically to the care of burned children. These centers served as role models that have completely altered burn care around the world. Their superb survival statistics made others realize that patients with large burns

were not automatically doomed but had a chance of survival if cared for in a specialized center. Laboratory and Clinical Research in burn injury improved other areas of trauma care as well. It became obvious that the burn patient with multi-system involvement was the perfect trauma model. The universality of the burn problems provided a reason for better international cooperation and exchange of ideas.

In 1960, the first international congress on research in burns was held in Washington, DC. At the second meeting in 1963, The International Society for Burn Injuries (ISBI) was founded and it has been conducting meetings every four years. The American Burn Association was founded in 1968. The society's membership was unique in that it consisted of all the members of the burn team, including nonphysicians (Dieticians, Physical and Occupational therapists, Nurses and Psychologists).

Indian History

Burns became alarmingly frequent in India in the modern age of industrialization. To pour kerosene over the clothes and then set them on fire is the most common form of committing suicide or murder. There are also innumerable instances of accidental burning caused by clothes catching fire on low stoves or open gas rings; the loose flowing end of 'saris' and 'dupatta' of Indian women increases this danger enormously. Open fires in winter are an added hazard. Acid burns of the face are frequently the result of blind jealousy. Suicidal burns amongst Hindu women are usually fatal because of its extent. Practice of tradition of 'Sati Pratha' declined in this period. Most of the burn cases in India are treated by General Surgeons and General Practitioners in small cities and rural areas because Plastic Surgeons are few and settled mostly in Metro cities. These General Surgeons and General Practitioners have negligible facilities and have no forum to exchange, enhance or update their knowledge. The initial local treatment on admission to hospitals varies according to the area involved in the burns face, front of chest and abdomen are routinely treated by the exposure method. Burns of extremities and fingers alone are dressed. The majority of hospitals do not have the 'Stryker Frame' and hence only circumferential body burns are dressed. Resistant strains of organisms have increased in recent years due to excessive use of antibiotics. Surgeons are not in favor of keeping grafts exposed from the start. Skin grafts are dressed with pressure pads for a week and then kept exposed. To keep the donor area exposed was attempted by many but were

not satisfied by this method. In fact, dressing of the donor area is retained for a fortnight during which the part heals. Severe cases of contractures of the flexor creases like the neck, axilla and elbow are released and skin grafted. Free grafts are preferred to tube pedicles as the relief is quick as well as complete.⁵

In India many Plastic Surgeons have contributed in the development of Burns Unit and management in modern era. Dr Noshir H Antia, the 3rd generation trained Plastic Surgeon under Sir Harold Gillies was the first surgeon to start a unit at Grant medical College and associated JJ Hospital, Mumbai in 1959. In 1964, Tata Trusts provided a substantial grant to carry out two projects one on Leprosy and other on Burns. In 1963, Safdarjung Hospital, Delhi started a department of Burns, Plastic and maxillofacial surgery with Dr JL Gupta as its head. Professor Antia felt that they should have a forum and thus, a Burn Association of India (BAI) was formed at JJ Group of hospitals, Bombay in 1972. Dr MH Keswani was the Secretary. Later under leadership of Dr Keswani the Burns Association of India (BAI) flourished with contributions like Boiled Potato Peel (BPP) dressings, prevention campaigns by way of radio and TV talks, small documentary ads, 'School Education Program' in burns etc. "Pour water on Burns" has received worldwide popularity. 'AGNIVARTA' is a quarterly publication of 'Burns Association of India' devoted to the problems concerning Burns. Burn injury is a disease of the poor at least in our country. Dr Keswani gave various modifications to reduce the cost of burns treatment like common homemade curd (called yogurt in the US) as a de-sloughing agent, Butter Milk Diet (BMD) as cheap high calorie high protein diet, X-Plasty of Vartak as a simple operation of release of contracture, Vartak's wheel as mesh graft dermatome, cellophane dressing for donor area, simple operation cum bath trolley, etc. Dr Keswani has to his credit the setting up of the first children's burn unit in India and India's first skin bank at Baijerbai Wadia Hospital in Parel, Mumbai in 1975 and 1978 respectively.⁶⁻⁸ In 1990, Prof J L Gupta convened a meeting at Pragati Maidan, New Delhi. A very active and detailed discussions and consultations were held amongst Prof JL Gupta, Prof Mathangi Ramakrishnan, Prof J K Sinha, Prof S P Bajaj, Prof S K Bhatnagar, Prof R K Keswani, Prof Siti Roy Choudhary, Prof PK Bilwani, Prof Madhuri Gore, Prof D L N Prasad, Prof Swarna Arora and Prof Anil Chadha and many others. This historic and significant meeting led to the birth of National Academy of Burns - India (NABI). NABI mainly aims at preparing and making available a

suitable appropriate and latest information relevant to all those concerned with burn care. Recognizing the services of Prof J L Gupta in the field of burns in the country, he was unanimously named as the Patron of NABI. Prof S N Sharma was the choice for the founder Presidentship. Dr S P Bajaj became the founder Secretary. The academy brought out an annual journal named 'Indian Journal of Burns' with Dr Rajeev B Ahuja and Dr ArunGoel as editor and assistant editor respectively. They worked for five years (1993-1997) before passing on the task to others. The first volume was brought out in 1993 and the journal is being regularly published. While NABI is an association of burn care professionals (doctors, nurses, therapists etc.), BAI even persons like businessmen, old recovered burn victims, etc. who were ready to serve the cause of burns in their own way. Dr JL Gupta gave guidelines for planning a Burns Unit.⁹

Subsequently many Burn Units have been developed successfully in various Institutions and Medical Colleges like Burn Unit in the Department of Plastic Surgery at Kasturba Medical College, Manipal, Karnataka, IPGME & R, Kolkata etc. of all the existing Burns Units in India, special mention is made of Burns Unit of Safdarjung Hospital, New Delhi which is the largest burn unit in the country and which has been modernized and equipped with all modern Burn care infrastructure facilities. 'Early Tangential Excision and skin grafting', 'Rescuer Burns', 'Policy of antibiotics in Burns' etc. has been popularized extensively by the Burns Unit of Manipal, Karnataka.^{10,11}

In India, Burn injuries due to fire works on the occasion of 'Diwali' are very common. Safety tips related to Fireworks have been explained by Anjali Burma.¹² The Government health system is not able to keep pace with population growth in recent years. Although major burn accidents are decreasing in relation to the population growth, the actual number of burn cases is on the increase. Gradually more and more teaching hospitals started separate Burn wards. Possibly about 60% of them are managed by the General Surgery services and the rest by a Burn and Plastic Surgeon.

The requirement for more burn beds encouraged many non-government groups into establishing burn management centers. Many of these centers have well equipped wards, trained support staff and enthusiastic Burn Specialists. These specialists have been instrumental in maintaining the prevention and rehabilitation programs concerning burns.^{10,11}

Recent Advances

What have been the out standing features of burn injuries in the last twenty five years? It is the better understanding of burn pathophysiology that is the most remarkable feature of last quarter of a century. The second important feature is the realization that the care of Burns is a team effort, the leader of the team being the one, who can lead the team most inspiringly, a person with vision, with dedication and with tenacity. It would not be fair to single out any one individual for all the advances. Half a century ago, the commonest cause of death following a burn greater than 20% was surgical shock, at least in India. With a better understanding of post burn surgical shock it is possible to treat this rationally and efficiently. The mortality from this cause has reduced considerably. Generalized infection of the tissues (septicemia) is the single most common cause of death following burns, at present. Better drugs and their wide-spread availability have helped us to control infection to some extent. However, while these drugs are useful, they have many undesirable side effects, some of them lethal. Moreover, the cost of these drugs is prohibitive. They have encouraged resistant strains to develop and they have put the clock back in many instances. Post burn sequelae need correction. These have been satisfactorily corrected by reconstructive surgeons and in many instances by interested general surgeons. Early post burn rehabilitation has been encouraged, but much progress needs to be made in this direction in this country. When the hands are burned, it is a severe blow to the person's economic viability. Better methods of rehabilitation need to be developed. Unfortunately over the last 25 years, not much progress has been made in this area. It costs approximately US \$1,000 per patient perday to provide satisfactory care in the Western world. This is clearly not possible in India and in many of the developing countries. Prevention of burns is the only logical solution. This is not easy and is time consuming. Easy or not, we have no option(s). We must prevent burns. Fortunately the Burns Association of India, which was formed in 1972, has been doing precisely that. Burns Prevention has to be propagated zealously by everyone who is able to do so, especially Doctors, Nurses, Paramedical workers, Social workers, teachers, surviving burns patients, and the media in fact it should be a national responsibility. India is a country with tremendous problems those of population explosion, education, malnutrition, unemployment and many more. Our

hopes lie in a unified approach to work together and solve some if not all of these problems.¹³

In 2019, the American Burns Association (ABA) began requiring psychological screening for PTSD (Post Traumatic Stress Disorder), depression, suicidal ideation and substance abuse and relevant intervention for burn centers as an aspect of accreditation. Burn survivors with psychiatric disorders are likely to experience longer hospital length of stay, more surgical procedures, higher levels of dysfunction, an increased need for medical assistance, and an increased risk of suicide.¹⁴

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