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Comprehensive Burn Care, Part I

There are a multitude of life-threatening complications and severe physiologic derangements that arise out of or can generally be related to one or more of six major problem areas that tend to compromise the management of the critically burned patient. Generally, encountered in the following order, these areas include: incineration, inhalation injuries, hypovolemic shock, sepsis, nutritional failure and incapacitating cosmetic and functional deformities. The current status of burn care is largely determined by the progress that is being made in the management of these problems.

Incineration may be fatal at the scene of the accident or, if not immediately fatal, may result in such severe damage that restoring the individual to a useful role in society is hopeless. Presently, it is not possible to salvage individuals with 100% full thickness burns and surviving an over 90% destruction of the integument is an extremely rare event. This issue has been philosophically debated in terms of withholding resuscitation in patients whose burns exceed a certain percent of the body surface area. There does not appear to be any justification for putting a limit on salvaging victims of thermal trauma and what appears unsalvageable today may be reduced to a minor problem in the near future. Occasionally, information gleaned from unsuccessful attempts to achieve the impossible provides the knowledge by means of which the lesser problem is solved.

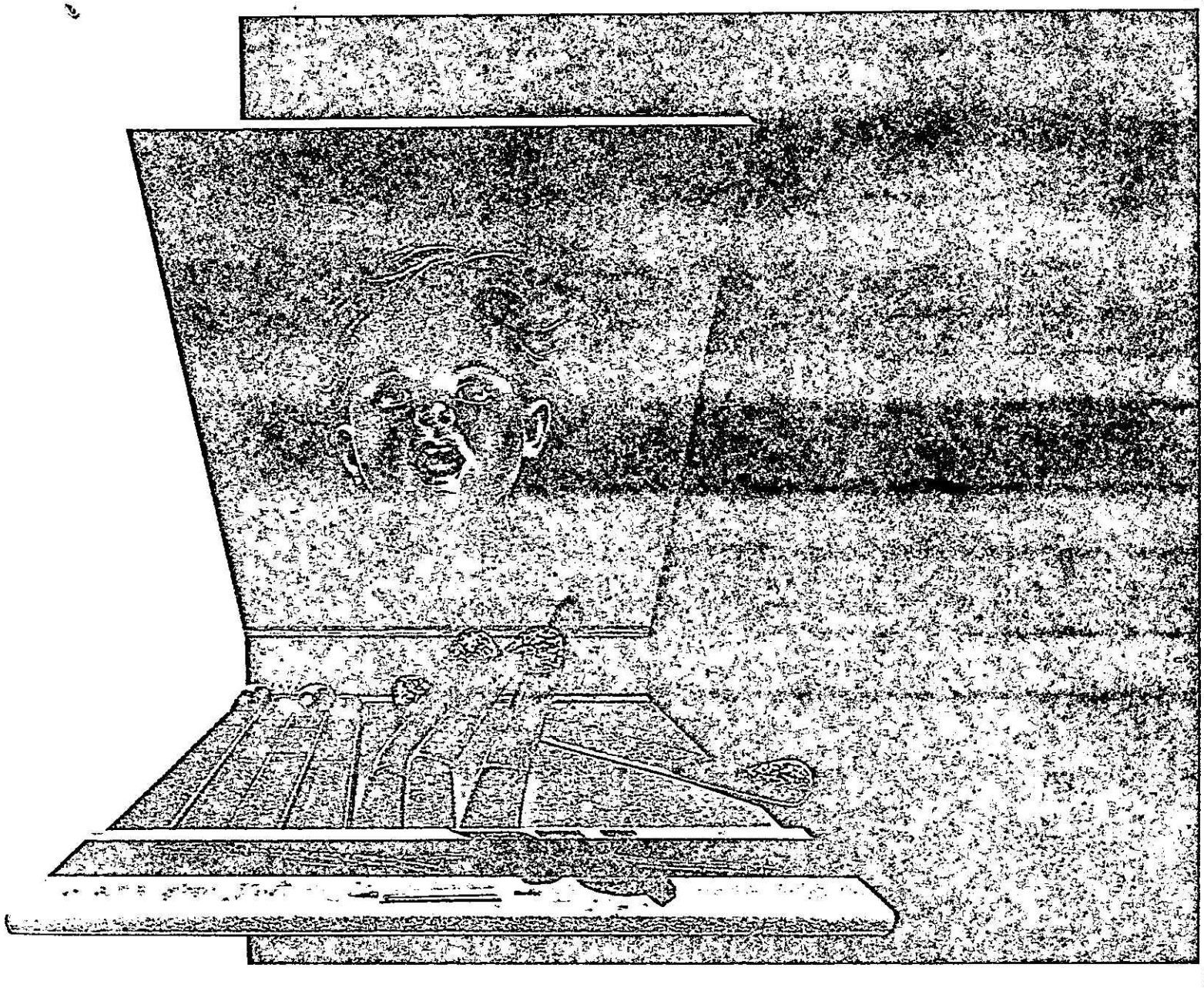
Overwhelming inhalation injuries incurred at the time of the accident, characterized by severe carbon monoxide poisoning, suffocation due to carbon dioxide accumulation, anoxia due to oxygen consumption by rapid combustion or the inhalation of toxic byproducts of combustion significantly contribute to early burn mortality. Death may ensue before the victim can be rescued. However, inhalation injuries are now being recognized earlier and treated more vigorously. If the victim is rescued alive, improved diagnostic procedures, sophisticated respiratory support and advances in monitoring techniques offer significantly increased possibilities for survival. Severe metabolic derangements, brain damage and pneumonitis usually result in death within the first 48 hours post burn and in some institutions are becoming the major factors in burn mortality.[1]

During the latter half of the 1940s hypovolemia was recognized as the major cause of death in patients with extensive thermal injuries. This new knowledge stimulated the development of several effective resuscitation formulas that dramatically reduced the incidence of burn mortality due to shock. Significant advances have been made in this phase of burn management and currently no patient should succumb to hypovolemic shock. On the other hand, the vigorous fluid and electrolyte resuscitative efforts now applied to severely burned individuals, often without resorting to a formula, have created a new hazard. Severe fluid overload resulting in congestive heart failure, pulmonary edema, cerebral edema and iatrogenic hypertension should evoke an awareness that "too much too soon" can be just as lethal as "too little too late."

The reduction in early post burn mortality that accompanied the ability to prevent shock was soon offset by an increase in mortality in the immediate post resuscitation period due to rampant streptococcal sepsis. At about this same time, penicillin became generally available and the control of streptococcal sepsis was ensured. The colonization of the burn wound by staphylococcus at approximately the fifth to seventh post burn day became the major problem and was compounded by the development of penicillin-resistant strains of staphylococcus. Newer antibiotics, effective against the penicillin-resistant staph, offered a temporary respite. Between 1958 and 1962, the emergence of virulent gram negative organisms predominated by pseudomonas aeruginosa became the major factor in burn wound sepsis. For the past two decades, pseudomonas sepsis has ranked high as one of the major causes of death in burn patients.

The advent of topical antimicrobials during the early 1960s brought about an apparently dramatic improvement in mortality due to sepsis but as data began to accumulate, it became obvious that the major improvements in survival were

Material presented with award-winning exhibit at the September 1978 ACEP/EDNA Scientific Assembly, Houston



limited to patients with burns involving less than 40% of the body surface area. Slight to moderate improvements were recorded in the 40%-60% burn range while the dismal survival figures for patients with over 60% burns remained virtually unchanged. The inability of the topical antimicrobials to penetrate the deeper levels of the burn wound in either bacteriocidal or bacteriostatic concentrations permitted colonization to occur in the depths of the wound. If unchecked, this led to bacterial necrosis of the devitalized tissue with subsequent invasion of neighboring viable tissue followed by systemic spread resulting in burn wound sepsis.

The disappointing performance of the topical antimicrobials was readily explained by the introduction of the burn wound biopsy.[2] This technique demonstrated that, although the surface of the wound was ostensibly clean, there was colonization and proliferation in the depths of the devitalized tissue that accounted for the incidence of septic complications. Nonetheless, topical antimicrobials have contributed significantly to a lessened morbidity and mortality in patients afflicted with deep partial thickness burns. The fact that deep second degree wounds heal spontaneously when treated with topical antimicrobials such as .5% silver nitrate soaks, mafenide or silver sulfadiazine and, untreated, are rapidly converted to full thickness injury by bacterial necrosis is an indication that they are protected from colonization by the antimicrobial activity of such topical agents.

The actual depth to which topical antimicrobials penetrate the wound is not known. Presumptive evidence has been obtained in our institution by excising deep dermal wounds layer by layer with the Brown Dermatome set at .4 mm until viable tissues are encountered. The appearance of two or more punctate bleeding points per square centimeter of eschar after the third layer has been excised identifies viable tissue at a depth of 1.2 mm. Recognizing that such wounds heal spontaneously when treated with topical agents permits the assumption that there has been sufficient penetration of the topical antimicrobial to protect the wound to a depth of at least 1.2 mm.

Additional evidence has been established by the microscopic study of unstained sections of full thickness eschar which have been treated with silver sul-

fadiazine for five or six days. The precipitation of silver salts on the surface of the eschar and the presence of silver particles at a depth of 200 to 300 microns from the surface of the wound are readily seen. Careful study of these sections fails to show silver deposits in the dermal collagen but as the dermal vasculature is examined, silver particles are again identified. The silver diffuses through the collagen layers and precipitates on basement membranes of the dermal vasculature at 1500 to 2000 microns from the surface of the wound. The concentration of the silver diminishes as distances from the surface increase and the presence of silver particles detected in the eschar at depths of 2 to 2.5 mm cannot serve to quantitate the concentration of antimicrobial agent that has penetrated to this level. On the other hand, the very fact that silver is present in the deeper levels of the eschar, as well as serum sulfa levels of 3.5 to 4.0 g% in burn patients treated with silver sulfadiazine, offers evidence that there is significant penetration of the wound. Based on these observations and clinical experience, it is estimated that silver sulfadiazine penetrates the eschar in bacteriocidal concentrations to a depth of at least 1.2 to 1.5 mm.

It is therefore logical to assume that a remnant of devitalized tissue less than 1 mm in thickness would be prevented by topically applied silver sulfadiazine from undergoing bacterial necrosis. Excision of the burn wound layer by layer until 2 to 3 mm islands of fat are encountered in the absence of bleeding identifies full thickness eschar. This remnant of devital tissue is less than 1 mm thick and does not become necrotic when treated with daily silver sulfadiazine dressings. After 14 to 17 days, graftable granulations replace the devitalized remnant of eschar.

The recognition that the burn eschar is the major source of septic complications, as well as the possibility that the breakdown products of necrosing devital tissue may play a significant role in the production of the hypermetabolic state, argues strongly for early excision of the burn wound. Although considered desirable, early total excision has not been generally accepted because of such problems as prohibitive intraoperative blood loss, the indiscriminate sacrifice of partial thickness burn, the necessity for covering exposed fat or fascia with biologic dressings and concern for subjecting the critically burned patient to a general anesthetic before resuscitation has been completed. Only in recent years has major excision of the burn wound become feasible.[3,4,5] In our institution, we have developed the technique of early laminar excision that not only encompasses these major objections but also accurately differentiates deep partial from full thickness injuries and permits optimal antimicrobial activity of silver sulfadiazine.

It is now well recognized that major thermal injuries evoke a hypermetabolic state that results in caloric and protein requirements that may reach two and one-half times normal.[6] The maintenance of adequate nutrition becomes the single most important factor in survival of the burn patient beyond the resuscitative period. Fulfilling nutritional requirements of this magnitude necessitates the employment of supplemental feeding regimens and the enteral route is by far the most efficacious. Neither wound healing nor the control of sepsis is achieved in the absence of adequate nutrition.

Rehabilitation of the healed but severely deformed victim of thermal trauma is the ultimate goal of the burn team. There is, of course, no hope for salvaging body parts initially destroyed by the thermal injury itself. It is therefore vitally important to salvage as much damaged tissue as good medical management can achieve in order to obtain maximal preservation of form and function. It also is important to avoid iatrogenic destruction of body parts and extensive debridement must be cautiously pursued. The application of proper splints and the early employment of occupational and physical therapy techniques play a critical role in the preservation of function. In those situations where damage cannot be accurately assessed, attention should be directed toward achieving as much healing as possible, temporarily accepting anticipated deformities. When survival is ensured, advanced techniques in reconstructive surgery, the application of improved prosthetic materials and the institution of psychiatric, occupational and physical therapies are the means whereby the majority of these patients can be restored to a useful role in society.

Application of advanced life support capabilities at the scene of the accident with the ability to control the systemic insult, improved means of rapid transport, effective triage, and the establishment of regionalized centers for care of the critically injured have contributed significantly to the reduction of early mortality due to all forms of trauma. Such improvements are a reflection of the critical role played by the emergency medical services whose highly trained, skilled and experienced personnel, bolstered by sophisticated equipment and facilities, culminate in earlier, more effective rescue efforts.

Recent years have witnessed a gradual progression from burn care based on local methods and philosophies toward the adoption of national standards of care.

In summary, early rescue, first aid, rapid transport, controlling the systemic insult, uniform resuscitation measures, early recognition and vigorous treatment of inhalation injuries, early excision of the wound with accelerated closure, improved control of infection with the judicious use of topical and systemic antimicrobials, effective nutritional support, the lessening of morbidity with improved occupational and physical therapy techniques and major advances in reconstructive surgery and prosthetic materials have significantly improved the management of severe thermal injuries.

Emergency Management of the Burn Patient.

Rescue, First Aid and Transport. Management of the burn patient begins at the scene of the accident. The first step in managing any trauma victim is a successful rescue. The victim should be removed to a place of safety where he can be properly evaluated. Care is taken to avoid aggravating fractures or spinal injuries that may accompany the burn as a result of an explosion, flaming auto accident, a fall or jumping from a burning building.

It is essential to stop the burning process. Flames should be extinguished by smothering or spraying with water, taking care to avoid re-ignition when flammable liquids are involved. Hot steaming clothing from scalds should be wet down with cool water and chemical burns should be continuously irrigated with water to achieve maximal dilution. Electrical injuries require special attention to avoid injury to the rescuers. The current should be interrupted or the patient carefully disengaged from contact with the electrical current. If the thermal agent is cold, as in frostbite, the victim should be warmed; avoid massaging damaged parts and do not let the patient smoke.

As rapidly as the situation permits, the airway, cardiovascular function and external bleeding are assessed and measures taken to correct any life-threatening systemic derangement.

The airway should be cleared and oxygen should be supplied by mask at 4-5 L/minute. If respirations are excessively slow or shallow and/or the victim is cyanotic, assisted ventilation by bag and mask is begun. Under medical direction, rescue teams with ALS capability may insert an oral endotracheal tube when prolonged respiratory assistance is anticipated.

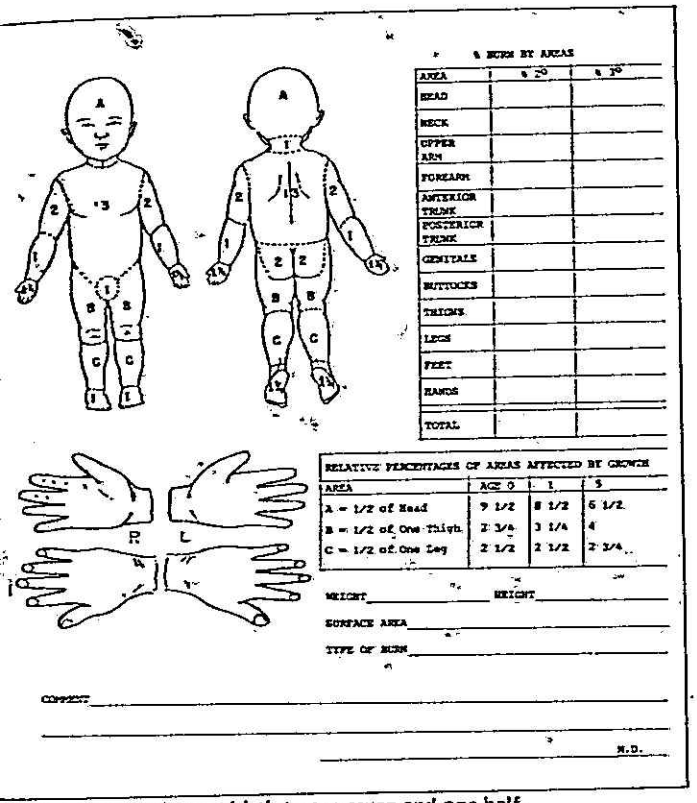


Figure 1A: Burn sheet — birth to age seven and one-half.

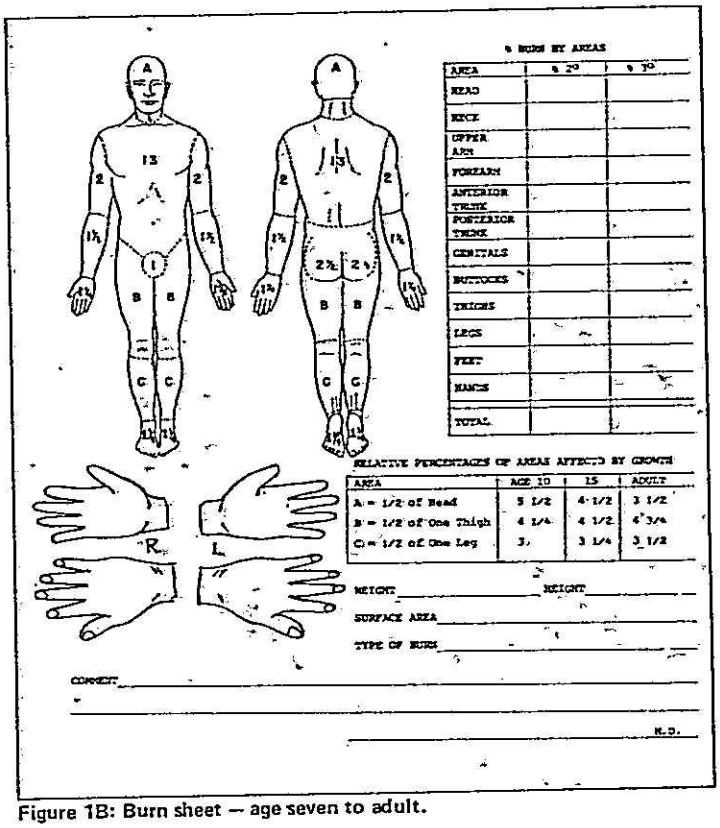


Figure 1B: Burn sheet — age seven to adult.

Cardiac function is assessed and pulse and pressure recorded. If the pulse is absent or slower than 60 beats per minute or a blood pressure is unobtainable or the systolic pressure is less than 60, closed chest cardiac massage should immediately be instituted. An intravenous line should be secured and lactated Ringer's administered at an initial rate of 5 ml/kg/hr. It is apparent that the weight is necessary and is obtained from the patient, a knowledgeable historian at the scene, or simply estimated. Freely running fluids through large bore intravenous lines can result in dangerous overload. Once started at 5 ml/kg/hr, the rate may be titrated to achieve an appropriate response to the intravenous therapy. Cardiac drugs are administered when physician directed or by local protocol.

Cardiac function should be monitored by electrocardiogram. If fibrillation is present, defibrillate at 50 watt/seconds per each 10 kg of body weight up to 400 watt/seconds.

External bleeding should be detected and controlled with pressure dressings. Any obvious or suspicious fractures should be immobilized by appropriate splinting.

Remove burned clothing but do not pull away fabric adherent to the wound. Cut around these areas and cover the exposed wound with sterile dressings moistened with saline; if not available, clean dry sheets or blankets may be used. Keep the patient warm if he feels chilly and guard against heat loss when outside air temperatures are cool or even below freezing.

The wound may be manipulated but unnecessary contamination should be avoided. The wound is not a life-threatening problem at this stage of care and neither debridement nor cleansing should be attempted in the field. Burn creams, ointments or home remedies should never be applied.

The size of the burn should be estimated utilizing the "rule of nines." This information can be used to determine the appropriate level of care that will be required for the patient as well as to alert the burn team to be prepared for the patient's arrival.

Pain may or may not be a predominant feature and the necessity for pain relief should be carefully evaluated. Patients with full thickness injuries are more likely than not to be anesthetic and what appears to be reaction to pain is fear and apprehension. These patients need a large measure of kindness and reassurance expressed in a positive way.

If there is severe pain and the time from injury is no greater than 30 to 45 minutes, a single intramuscular injection of meperidine or morphine may be helpful. Cool compresses dramatically relieve pain but cooling more than 25% of the body surface area may lead to severe hypothermia. In extensive burns, preferential cooling of sensitive areas such as the hands, forearms, feet, ankles, face, ears and neck can alleviate pain to a significant degree. When intravenous therapy has been initiated, .05 mg/kg of intravenous morphine up to a 4 mg dose offers the most effective analgesia. Narcotics should not be employed when there is concern about a head injury.

The burn patient should not be permitted any oral intake other than a superficial moistening of the lips. Patients with extensive burns rapidly develop an ileus and vomiting and aspiration can be a hazard.

The comatose patient should be evaluated for possible etiologic factors. The essential possibilities to be considered include head injury, suffocation, stroke, drug ingestion and diabetic coma. Many patients with serious illnesses wear a flame proof tag that provides invaluable medical information.

During the evaluation, rings, bracelets or any constricting jewelry should be removed before edema of the parts renders removal, other than by cutting, impossible.

After these emergency measures have been instituted, the patient should be transported to a facility of appropriate capabilities, preferably, prearranged by established protocol. If the extent of injury exceeds the capabilities of the institution to which the patient has been transported, consultation should be obtained, additional therapy carried out as recommended and, when stabilized, the patient should be transported to the appropriate institution.

During transport, first aid measures should be continued and upon arrival

continued on page 75

BURN CARE *continued from page 11*

at the destination, rescue personnel should effect a smooth transfer of responsibility to the emergency department or burn team personnel, avoiding any inadvertent lapse in critical life support measures.

Accurate records of treatment received, medications administered and times involved are vitally important to ensure optimal continuation of care and avoid inadvertent over-medication.

Resuscitation and Initial Care. With rare exceptions, decisions regarding the necessity for hospitalization should not be made in the field. It may be appropriate in the case where there are mass casualties and limited facilities to bypass hospital care for victims who have small (less than 1%) superficial burns and no evidence of associated injuries. In such situations, there will almost always be a physician present with experience in burn care who can assume responsibility for triage.

In general, hospitalization is recommended when:

- The total burn exceeds 10% of the body surface area or there is greater than 2% full thickness burn. These criteria are halved for patients under two or over 40 years of age.
- Hands, face, feet or genitalia are involved.
- There is evidence for or suspicion of inhalation injury.
- Associated injuries are present.
- There is a suspicion that the burn was inflicted.
- The burn is infected.
- The burn is circumferential.
- There is a history of prior medical illness.
- The patient is comatose.
- The patient or family are unable to cope.

Upon arrival at the hospital, the care of the patient should be transferred from rescue personnel to hospital personnel without permitting any interruption in treatment.

When there is a specialized unit for burn care in the definitive institution, the patient should be admitted directly to that facility. Otherwise, the initial management should be conducted in the emergency department or operating room. Protective isolation should be established, all manipulations should be conducted in a warm environment or under a heating device and all personnel should wear caps, mask, gown and gloves.

There are four major tasks to be accomplished and team effort is required:

Initial Wound Care. All clothing must be removed and the patient weighed; the wound cleansed either by copious saline irrigations or gentle sponging with a mild detergent soap; all devitalized skin and blisters debrided and extremities and thorax evaluated for the necessity of immediate escharotomy. Any circumferential third degree burn involving more than one-third of an extremity or more than two-thirds of the circumference of the thorax will probably require escharotomy. Careful monitoring of the peripheral circulation by Doppler is an invaluable aid to determining the necessity for escharotomy.

Resuscitation. The extent of the injury is accurately mapped out on a burn sheet and fluid and electrolyte requirements are calculated (*Figures 1A* and *1B*).

Day 1: % burn x BW (kg) x 2 = ml L.R., 1/2 first 8 hours post burn.* (Remainder equally divided over the next 16 hours.)

Maintenance fluids — 1500 ml/m^2/day, L.R.

Adequate for burns up to 20%. For every 1% of burn over 20%, add to each liter of resuscitation fluid:

1.5 mEq $NaHCO_3$ up to 80 mEq/L maximum

1.0 mEq KCl up to 40 mEq/L maximum.

*Subtract from this amount any fluids previously administered.

Day 2: Same fluid volume. If using hypertonic solutions, monitor electrolytes at four hour intervals beyond 18 hours post burn. Stop hypertonic fluids after 24 hours or sooner if the serum sodium reaches 150 mEq and continue with isotonic fluids. Monitor

hourly: vital signs, urinary output (20 cc/m^2/hr) and CVP for burns over 60%.

Day III and following: Regulate fluids to maintain adequate urinary output, fluid and electrolyte balance and hydration until oral intake is established.

Additional pain medication, appropriate cardiac stimulants, steroids, antibiotics, tetanus immunization and special medications such as insulin for the diabetic are calculated and administered.

Specialty Lines and Blood Work. A rapid assessment of the existing intravenous lines is made and additional lines established as indicated. Patients with burns over 20% should have a venous cut down established. This may be done through the burn surface when necessary. A CVP line should be instituted when the patient is elderly, manifesting signs of shock or has a burn in excess of 60% of the body surface. Cut down incisions should be meticulously closed. Arterial lines are recommended when patients are already in shock and the distribution of the burn precludes obtaining accurate cuff pressures. A Swan-Ganz catheter should be used in patients with severe inhalation injuries or in elderly individuals with unstable cardiovascular systems.

Percutaneous subclavian punctures are hazardous in infants and small children and are not recommended. An indwelling urinary catheter should be inserted when the burn is over 20% of the body surface, the genitalia are involved or shock is present. A specimen is obtained for urinanalysis and urine output and specific gravity should be checked hourly. Ideally, urinary output should be maintained at 20 ml/m^2/hr. If urine is black or grossly bloody, a mannitol flush is administered. Base line laboratory studies should be drawn including a CBC, electrolytes, BUN, sugar, total protein, creatinine, Ca and Mg. Blood gases, carboxy hemoglobin and pH should be obtained if there is suspect or overt evidence of smoke inhalation.

General Assessment and Cardiopulmonary Stabilization. An initial history should be obtained noting the etiology of the injury, the presence of acute intervening illnesses or chronic disease problems, allergies, immunizations and exposure to contagion — followed by a detailed history when time permits. A physical examination is done with special assessment of the cardio-circulatory status, pulmonary function, renal function, the presence of abdominal distention, evidence of airway burn or smoke inhalation, ophthalmic involvement and other injuries. A nasogastric tube is inserted

graduate review

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The following are actual cases which present an opportunity for self-evaluation and review. As a result of these cases in emergency care, you should be able to:

- List and describe the major types of wounds.
- Recognize the different classifications of fractures.
- Describe the emergency care for fractures.
- List the actions necessary to treat shock.
- Describe the emergency care for puncture wounds.
- Recognize the different types of wounds.

Case I: On a dark, rainy night a young woman is struck by a car while walking across a street. When you arrive she is lying in the street by the curb. She complains of a great amount of pain in her legs.

1. What two types of wounds would you expect this woman to have?
   A. _____
   B. _____
2. What are the other major types of wounds?
   A. _____
   B. _____
3. The young woman's lower left leg is badly swollen. What bone fracture would you suspect?
   A. ___ Tibia
   B. ___ Fibula
   C. ___ Femur
   D. ___ Patella
   E. ___ Radius
4. What type of attention would you give this leg fracture?
   _____
5. After cutting her pants away, you find a bone protruding from her lower left leg. What type of fracture is this?
   A. ___ Simple — closed

in the stomach, the stomach irrigated with saline and the tube is maintained on continuous suction. A portable chest film and a base line EKG should be obtained. X-ray all fractures and check the position of central intravenous lines and all tubes. Continuous cardiac monitoring is desirable in the over 50% burn patient. If respiratory distress is evident, humidified oxygen is supplied. An arterial pO_2 of less than 50 mm Hg is an indication for intubation and respiratory care.

The use of steroids in inhalation injuries continues to be controversial; however, we believe there is definite benefit to be derived from their early use when smoke inhalation is confirmed or strongly suspect (i.e. burned in a closed space, facial and intra-oral burns, x-ray evidence of pulmonary involvement, carbonaceous material in the nose and throat or in tracheal secretions). A loading dose of 20 mg per kg of Solumedrol is administered intravenously followed by 5 mg/kg IV every six hours. Once begun, steroids are usually continued for 48 to 72 hours. Tracheostomy is avoided except where intubation is impossible or supraglottic edema threatens to obstruct airway.

Antibiotics. Aqueous penicillin, 50,000 units/kg/day up to 4,000,000 units/day is routinely used during the first four to five days post burn to prevent streptococcal sepsis due to endogenous organisms. Beyond this point, antibiotics should be reserved for the treatment of invasive burn wound sepsis or pneumonia. When wound cultures show a persistently heavy growth, specific antibiotics should be employed based on sensitivity studies. Positive blood cultures should be treated with gentamycin and methicillin until sensitivity studies are available and changed to the appropriate antibiotic thereafter.

The routine use of antibiotics is an invitation to yeast or fungus sepsis. Invasion of the burn wound by these organisms is becoming an increasingly serious problem.

Oral mycostatin, avoiding prolonged use of intravenous catheters and bladder catheters, the judicious use of antibiotics, aggressive wound care and the maintenance of adequate nutrition are helpful in curtailing candida sepsis. When candida is recovered from blood cultures, stop all antibiotics and start oral flucytosine at maximal doses until sensitivities are available. Then continue therapy with the appropriate anti-fungal agent. •

B. ___ Impacted

C. ___ Comminuted

D. ___ Compound — open

E. ___ Greenstick

6. If this patient were to go into shock, what might be the underlying causes?

A. _____

B. _____

C. _____

7. What would the treatment for shock be in this emergency situation?

A. _____

B. _____

C. _____

D. _____

E. _____

F. _____

Case II: While on an evening out to a major metropolitan area, you are the first person to reach a teenager who has been shot in the abdomen.

8. What is the emergency care in this situation?

A. _____

B. _____

C. _____

D. _____

E. _____

9. What type of wound do all gunshot victims suffer?

_____

10. List the other major types of wounds.

A. _____

B. _____

C. _____

11. What is the other emergency that falls within the wound category?

_____

Answers are on page 100

The following bibliography can be consulted by the EMT for information regarding the emergency care of wounds.

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INITIAL BURN MANAGEMENT

IN THE FIELD

1. Remove patient from fire or source.
2. Establish airway; if still not breathing, administer CPR.
3. Make sure there are no associated injuries needing attention (e.g., cervical spine fracture, external hemorrhage).
4. Wrap in clean sheet or blanket and transfer to E.R.

IN THE EMERGENCY ROOM

1. Check airway for patency; check vital signs.
2. Make sure there are no associated injuries needing attention (e.g., cervical spine fracture, external hemorrhage).
3. Remove clothing and estimate burn size (Rule of Nines).
4. Obtain rapid history, and perform physical: time, type, place of burn; medication; allergies, etc.
5. If over 20% burn size, initiate resuscitation.
   - A. Insert large bore (at least 18 gauge) intravenous catheter preferably in an unburned area, and commence administration of Ringer's lactate (see formula below).
   - B. Insert Foley catheter.
   - C. Insert nasogastric tube.
6. Treat the burn wound.
   - A. Tetanus prophylaxis.
   - B. Check peripheral pulses of hand and foot. If inadequate in the face of normal vital signs, be on the alert for danger to the peripheral circulation.
   - C. Remove gross contaminants, chemicals, and loose tags of skin from the patient using sterile technique and copious warm saline irrigation.
   - D. Do not give analgesics intramuscularly or orally if patient is unstable.
   - E. Give intravenous analgesics only when the patient is stable, and neurological and abdominal injuries have been ruled out.
   - F. Do not apply any topical agent.

IF TRANSFER TO THE BURN CENTER IS DESIRED OR IF THERE IS A QUESTION CONCERNING TREATMENT CONTACT BURN CENTER VIA EMRC

FORMULA

All formulae are aimed at reestablishing an adequate circulating plasma volume. The best guide to this is the urine output - aim at 50-100 ml /hr in adults and 30-40 ml /hr in children. The simplest formula is the Parkland formula:

Lactated Ringer's (without glucose) in the first 24 hours = 4 ml /kg weight/% burn.

Give ½ in the first 8 hours, and ½ in the next 16 hours.

INDICATIONS FOR TRANSFER TO BURN CENTER

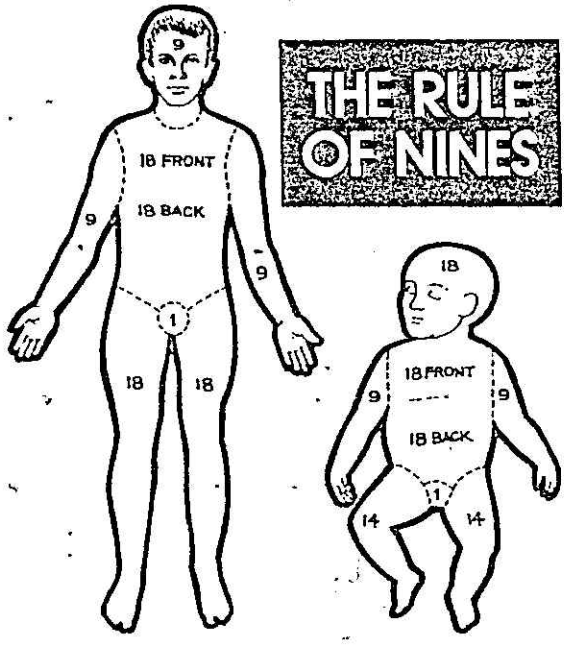
1. Second and third degree burns.
   - A. Greater than 10% in patients under 10 or over 50 years old.
   - B. Greater than 20% in other age groups.
   - C. Burns of the face, hands, feet or perineum.
2. Electrical burns.
3. Chemical burns.

DO NOT:

(1) Panic.

(2) Perform a tracheostomy unless the patient cannot be intubated or has a cervical spine injury.

(3) Give intramuscular or subcutaneous medications.



MARYLAND - EMERGENCY MEDICAL SERVICES