TREATMENT OF SEVERE BURNS ON BOARD SHIP IN SEA DISASTERS*

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SUMMARY. Nowadays international trade is expanding enormously, and this will involve more and more seagoing trade. In this age of globalization, numerous large ships sail in every possible condition, under various flags, and with hired crews. The crewmembers often come from the developing countries and may be untrained and ignorant of the rules of seafaring life. In the event of disasters at sea such sailors may be lost or severely injured. It is necessary to inaugurate new basic principles for saving lives in sea disasters, when conditions are very different from those on shore. Severely burned patients are in immediate danger for their lives and final outcome. The treatment of burns depends on appropriate first aid, which improves the outcome. But in sea disasters first-aid measures may be insufficient as crew members have to be winched off the wreck whether they are injured or not. New principles are outlined, as also the necessity of a centralized installation by the World Health Organization. Knowledge of these special measures for the particular conditions operative in sea disasters must be transmitted to all seafarers, researchers, and captains of ship. In this way the patients - often young men - can look forward to better fortune.

First measures in the area of a land-bound catastrophe by the emergency doctor

1. Saving
2. Reanimation
3. Blood staunching
4. Placing in health-maintaining position

Fig. 1 - Basic medical measures for saving lives in accidents and disasters on land.

Fig. 2 - Land-bound catastrophes.

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requiring complete medication and assistance.

In disaster situations, burned persons, especially those with severe burn wounds, are to be ranked in Category 4, which means temporary therapy with analgesics until physicians are available with specialized late treatment.

First aid in severely burned persons involves expensive and intense medical procedures. Depending on the duration of the period of exposure and the intensity of the burn, the surface of the skin - which is the largest organ in the body - will be thermally damaged.

There are three degrees of skin burns that must be fully understood:

1. first degree, with superficial reddening and formation of oedema caused by impairment of the epithelium;
2. second degree, with damaged corium and resulting blisters;
3. third degree, with tissue injuries deep into the adipose tissue of the subcutaneous fascia and even destruction of the appendages of the skin.

The vessels within the damaged area become semi-permeable and are subject to electrolyte disorders and a massive loss of body fluids. The resultant liquid creates massive oedema and extracellular sequestered formations. This is the first step towards the burn disease, and can be interrupted only by qualified infusion therapy. This primary therapy requires infusions of about 6000 ml during the first 6 h, after which the infusion quantity is calculated according to Evans’ rules in relation to the percentage of burned body surface area and body weight. In the event of a massive number of burn victims, the delivery of body liquids cannot be guaranteed, and in such cases the injured persons are in priority category 4.

In big disasters on the high sea, very special and difficult conditions for lifesaving and recovery are to be taken for granted. To locate and reach a distressed ship requires the use of planes and helicopters. Experience shows it takes at least 16 h to locate, reach, and transfer the rescuers, exceeding the 6-hour limit for the provision of first aid. However, on board ship, it is not possible to store and supply greater infusion quantities.

First of all, a “fact-finding” team has to be winched down from a helicopter, with a medical specialist for first-aid treatment who also initiates further lifesaving procedures. In the meantime, all visible injured persons, without any exception because of the seriousness of their injuries, are transported by the first helicopter - any empty return flight to the home station would be unreasonable. At sea, every rescued person is a survivor, and this always means keeping the distressed ship above water as a floating platform, always located and approached by helicopters.

If there is not enough room on board for the storage and supply of sufficient infusion quantities required for first aid to seriously burned persons whom it may not be possible to transport by helicopter, the arising emergency situation will require primary wound dressing for the prevention of massive loss of liquids, electrolytes, and protein (Fig. 3).

In our first-aid surgical procedures, we have had many successful experiences using the primary, temporary wound dressing MEDISKIN, a collagen material consisting of fresh, sterile, porcine skin. The structure of this white porcine skin is very similar to that of human skin. The material does not develop any vascular combination with the wound bed, with the result that all antigen-antibody reactions are totally absent. It also adheres to the wound bed and thus dramatically reduces liquid loss. Wound contamination is thus nearly impossible, and the painless transportation of the patients, which in such conditions is always difficult - especially on distressed ships - can be effected, also preventing the occurrence of shock.

Under the primary wound dressing with porcine skin, the usually considerable pain is reduced to a tolerable level, leading to early suspension of any doses of morphine. MEDISKIN is available in flat skin-like surfaces in small supplies at room temperature, so that there is no problem about storage in cramped shipboard conditions until it is needed. Using porcine skin as a primary wound covering, there is no need for specialized medical staff, as even inexpert personnel can cut the collagen material into wound-corresponding pieces. Immediately after being placed in position, MEDISKIN adheres to the wound bed owing to its high-protein exudate, offering the patient
great benefit and above all preventing the loss of body liquids during the first 6 h. All conclusions with regard to the extent of burned body surface, in proportion to age of the patient, that beyond a percentage of 80 prognosis is unfavourable could be brought into question by this primary wound dressing.

**Method**

When we started to use this primary wound dressing with porcine skin in 1969, the material, freshly gathered from a local slaughterhouse, had to be washed in a penicillin solution before it was ready for coverage of the wound bed. Some time later on we were able to obtain fresh, sterile, frozen porcine skin, which simplified the procurement of the material. But the use of fresh frozen skin necessitated storage in a refrigerator. Later, porcine skin collagen was developed by the industries, making non-problematic, long-term storage possible in normal room-temperature conditions.

Fresh burn wounds are sterile because of the effect of heat for about 48 h. After admission of the burn victim and first aid for the relief of shock, the wound is washed and immediately dressed with MEDISKIN. Owing to its high protein secretion, the wound dressing adheres to the wound bed within a few minutes. The wound becomes sealed up, but has to be treated according to the principles of continuous “open” wound treatment. Epithelial tissue forms underneath the wound dressing from the lip of the wound, gradually detaching the porcine skin from the wound bed, drying up and dividing like crisps. If the wound dressing comes apart because of infection, it can be replaced without any difficulty. Continual narcotics, changes of dressing material, and the washing-off of ointments are unnecessary owing to the lack of keloid formations in subsequent scars.

**Results**

Between 1969 and 1998, 265 patients with severe burn wounds (first, second, and third degree) treated in our first-aid hospital received a primary temporary wound dressing consisting of porcine skin (162 males, average age 32.5 yr; 103 females, average age 44 yr).

All the patients showed a clear reduction of about 60% in the initial demand of infusion quantities. The observation of Evans’ rules and the monitoring of all necessary calculable parameters led to a much higher survival rate - only four males and one female died of burns disease.

It was possible to dramatically reduce doses of high-potency analgesics and the patients were able to perform early training, for example maintaining permanent adequate function of a severely burned hand in order to carry out all necessary activities.

The period of stationary treatment was significantly reduced, especially in patients with small extents of burned body area; the healing period was also reduced, and frightening keloid scars were reduced to small tissue formations. With porcine skin wound dressing, we were able to do without permanent narcotics, changes of dressing material, and wound ablation, with the development of new non-irritant intrinsic textures. Using this primary porcine-skin wound dressing and its derivatives such as MEDISKIN, we have been able to show that the rule that survival is improbable if the sum of the burned body surface area in percentage and the patient’s age in years exceeds 80 should be reconsidered.

**Discussion**

MEDISKIN comes in layers the size of an exercise book, and this porcine-skin collagen therefore requires little space for storage and supply in adequate quantities, without any special storage temperature, even in shipboard conditions. This wound dressing can also be used by non-experts, so that is useful on warships. The dressing is extremely effective because it significantly reduces infusion quantities during the first 6 h by up to a third and extends the time period for finding injured persons and supplying first aid, thus leading to much better prognosis. Also, the difficult transfer of burn victims by helicopter or the like is painless, saving the patient from re-shock. The subsequent transfer of the most severely burned patients to the final supporting regional hospital will enable them to benefit from professional therapy with calculable parameters.

Therefore, it is in the interests of ships’ crews and of their health and life aboard both civil craft and warships that adequate quantities of porcine skin should be available, and non-medical personnel should be informed about its use. During the Falklands War, within the whole spectrum of injuries sustained in state-of-the-art nautical conditions, there was a clear shift towards burn injuries: 65 to 80% of the wounded soldiers had burn wounds, which can thus be considered a mass occurrence.

Burn injuries always benefit from the immediate cooling effect of cold water to block the “afterburn” effect in deeper tissue layers. As there is normally a lack of adequate infusion fluids, the injured persons should be urged to drink large quantities of saline solution. However, as the primary aim in big sea disasters is to keep the wrecked ship afloat, all persons providing assistance have other priority activities to keep them busy, and it is hard for them to take stock of all the problems. For this reason, after initial first-aid treatment, burn victims are on their very own.
RESUME. Aujourd'hui le commerce international est en phase de grande expansion, ce qui portera à un volume toujours majeur de commerce maritime. Dans l'âge de la globalisation, il y a un grand nombre de navires de grosses dimensions qui naviguent en toutes les conditions, sous divers drapeaux et avec des équipages à la journée. Les membres de l'équipage, qui proviennent fréquemment des pays en voie de développement, ne possèdent souvent aucune formation professionnelle et ne connaissent pas les règles de la vie de marin. En cas de désastres en mer, les marins peuvent perdre la vie ou être atteints de graves lésions. Il est nécessaire d'introduire de nouveaux principes fondamentaux pour le sauvetage de la vie dans les désastres maritimes, quand les conditions sont très différentes de celles à terre. Les grands brûlés courent des risques immédiats pour leur vie et pour le résultat final. Le traitement des brûlures dépend des premiers secours appropriés, qui améliorent le pronostic. Cependant, dans les désastres marins, les mesures de premier secours peuvent être insuffisantes parce que les membres de l'équipage doivent être hissés hors de l'eau au treuil, qu'ils soient lésés ou non. L'Auteur indique les nouveaux principes, comme aussi la nécessité que l'Organisation de la Santé Mondiale crée une installation centralisée. La connaissance de ces mesures spéciales pour les conditions particulières qui opèrent dans les désastres en mer doit être transmise à tous les marins, à tous les chercheurs et à tous les capitaines de navire. En cette manière les patients - souvent de jeunes hommes - pourront avoir une meilleure fortune.

BIBLIOGRAPHY


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