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The use of hydrogel dressings

Respiratory tract  
Part I

Practical  
education  
of rescuers

ECG - compendium of knowledge for medical rescuers  
Part III

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# The use of hydrogel dressings under mass event conditions

**B**urning (Latin *combustio*) means skin damage, but also depending on the degree of burns, damage to more deeply situated tissues or organs. A burn occurs as a result of the action of warmth, caustic substances (solid, liquid, gaseous), electrical current, UV radiation or another type of radiation.

Such damage can be local, limited to the place of affected by the factor – in this case we deal with a burn – then we deal with a burn or in the case of a larger burnt surface, the results can also have a general systemic character. In such a situation we talk about burn injuries and burn disease<sup>4</sup>. It occurs in heavy cases covering at least 15–20% of the body surface (1). Medium server and severe burns should be treated in specialised burn treatment centres. Lighter burns can be treated at branches and selected sub-branches at general surgery and children's surgery clinics. The condition for participation is the presence of appropriately prepared and experienced personnel, the so-called burn syndrome (2).

The rescue action undertaken at the accident site is aimed at stopping the damaging and limiting factor of its effects. The burn treatment and the patient's health are determined during the first minutes and hours after the accident. Already at the initial stages of the procedure (ambulance services, city or district hospital) the resuscitation procedure of the burnt

person should begin. Errors committed during the first minutes and hours after burning may determine the successful results of the treatment

## Assessment of the burn severity

The extent of burns is the basic parameters used by rescuers to determine their severity. The following methods are used for this purpose:

- Wallase's rule,
- the hand rule
- the rule of fives,
- table and diagram methods.

Each of these methods has its proponents and opponents. However, the determination of the surface of the burn itself is not a sufficient indicator allowing for full evaluation of its consequences. The injured person's survival is determined by at least six main factors which, at various combinations, allow for determining the severity of burns, the course of the burn disease, the occurrence of complications and the success of the treatment.

The first of the analysed factors is the extent of the burn injury. Surface area is determined in percentages. In the assessment only 2nd and 3rd degree burns are taken into consideration. The reddening itself (first degree) is not a symptom of a more severe injury influencing the prognosis.

Another factor is the depth of the burn injury. Directly at the accident site, especially in the case of a mass-casualty incident, the assessment of the burn injury can be inhibited. In such a case, an analysis of the damaging factor can be helpful. Chemical compounds usually induce deep burns.

The age of the burnt person, together with the factors discussed above, plays

### Summary

Burns are one of the most common injures. Fast and correct emergency care reduces the destructive influence of high temperature on the human body.

### Key words

Mass-Casualty Incident, burn, triage, hydrogel dressing

an important role in the prognosis. The risk of death is higher for the injured patients below two years of age and above 60 years of age.

Also another factor is connected with age. Elderly persons usually suffer from chronic diseases. Stress connected with burning makes these diseases more acute together with all of their consequences. Therefore, younger and healthier persons have greater chances of survival with the same type and size of the injury.

The location of the burn wound is important for the determination of the severity of the burn. Face, neck and chest burns are connected with the risk of simultaneous occurrence of upper respiratory tract burns. Injuries in the area of the face, feet, hands, perineum, joints, sex organs are difficult to treat and often leave deformations and permanent mobility limitations.

The accompanying mechanical damage, e.g. broken bones, bruises, injuries make the treatment more difficult and, as a result, worsen the patient's prognosis.

By performing the preliminary and secondary triage of patients, we take into consideration all of the factors described above. They will determine the method and scope of the aid provided at the accident site, the order of transport and allocation of injured persons at hospitals. Some factors can be modified under the influence of our procedure.

Usually the severity of burns is defined by taking account their depth and surface area. The surface area has found its application in the classification of burn severity according to the principles provided by the American Burn Association (3).

## Mass-Casualty Incident

A mass-casualty incident is a specific type of event in which the patient's needs resulting from the number, type and severity of injuries cannot be satisfied to an extent known from everyday practice. It is necessary to use simplifications and, in some situations, medical compromises.

By performing preliminary medical triage, we gain the well-known AcBCDE procedure in which E means the exposure, the mechanism, the type and size of the injury – in this case the dressing area (in percentages), its depth etc. Prepared appropriately early safely reduces the exposure to the damaging factor and influences the triage results. During the preliminary triage, we are obliged to perform certain simple rescue services, aimed at securing the patency of the airways: laying the casualty down safely, stopping the bleeding and performing other activities which are of significant importance for the casualty – in our case this will be the casualty's removal from the sources of heat, fire extinction, stopping the contact with hot objects (burning clothes, all jewellery – bracelets, rings). Each casualty should be treated as a patient after the injury, hence we will immediately perform a BTLS examination (4).

## Preliminary procedure

After conducting the preliminary triage, we define the scope of necessary rescue activities and the method of their performance at the site. For burns, the most important role will be played by cooling down the burn injury.

Burning or smouldering clothes can be extinguished by covering them tightly with a blanket or another material. Next, we need to remove clothes moistened with hot liquid or steam without tearing away clothes stuck to the skin or melted into it forcibly. Additionally, all rings, bracelets, watches should be removed as it may prove to be impossible later on due to the oedema which may lead to bleeding. Later, the burn injury must be covered with a sterile dressing or a bedsheet. If possible, hydrogel dressings can be used and finally, the casualty should be protected against excessive cooling (blanket, tinfoil).

In a mass-casualty incident, an insufficient amount of time which can be devoted ►

► to the casualty during the first minutes of the action, forces us to use innovative solutions to quickly stabilize casualties at the accident site and stopping the action of the damaging factor. The most frequent errors encountered in ad hoc dressing of burns include:

- transferring patients without any preliminary treatment of the burn shock,
- no certain venous route (intravenous cannula, central contact),
- too small an amount of the infusion liquid transfusion,
- no elementary local dressing of the burn, no administration of painkillers.

In a mass-casualty incident, the scale of these errors will be much greater. We will deal only with problems of the burn injury.

In routine actions, the cooling of the burn injury with water at room temperature for at least 15–20 minutes is commonly recommended. But how can it be done effectively in a mass-casualty incident? Fortunately, hydrogel dressings are more and more commonly used by rescue services.

### Simulation of a mass-casualty incident

During the 4th Open Masovia Medical Rescue Championships, a simulation of a mass-casualty event was conducted. For the purposes of the simulation, a group of casualties was prepared. They were characterised by burn injuries resulting from contact with flames during an explosion. During the exercise, the actions taken were evaluated and attention was also paid to the method of protecting burnt patients. The possibility of using hydrogel dressings during such an incident was evaluated.

After the preliminary triage of the casualties, the process of their evacuation from the stadium stands began (the event site) to the medical point designated by the person managing the action. At this point, the secondary triage was performed, the order of transport was

established and the hospital was chosen to which all the casualties were then taken.

A preliminary analysis showed that the character of a mass event considerably limits the possibility of quick and sufficient cooling of burn injuries using the methods used in everyday practice. Similar observations were made during actual events, e.g. after the fire at the Entertainment Arena at the Gdańsk Shipyard in 1994 (5). The focus of attention on other procedures with co-existing mechanical injuries resulting in the inability to implement this element of action correctly. The use of hydrogel dressings changes this situation. Hence the use of such dressings was found in the procedures for the State Fire Service (procedures no. 16 and 17).

Hydrogel dressings are a water composition of natural and synthetic polymers. They can occur in liquid and solid form. The BurnTec dressing used during the exercises is available in the form of solid hydrogel. To ensure appropriate mechanical resistance, it was reinforced all over of its surface with nonwoven fabric. In this way, a durable patch of hydrogel was obtained, which allows for its even distribution over the entire injury and modelling it, while retaining all characteristics of hydrogel.

The stable structure of hydrogel protected the hydrogel from flowing down from the dressing during the performance of rescue activities on the patient, which proved to be very important during the evacuation from the zone and during the transport. The risk of hydrogel flowing down in semi-liquid form reduces the action of the dressing because of uneven distribution of the cooling substance on the surface area of the injury. It also creates a threat by forming a slippery surface near the patient. The use of liquid gel can cause slipping and injuries, while its flowing down onto the chest may increase the risk of defibrillation. Stable

structure of the hydrogel prevented this dangerous phenomenon.

One of problems during the cooling of burn injuries is the problem of cooling. The hydrogel stability allowed for limiting the cooling process exclusively to the injured place. Next, the use of a space blanket allowed for ensuring warmth comfort to the patient while waiting for the transport and also during the transport.

Face burns and, as a result, airway burns required dressing during the exercise. The application of dressing in the form of stable gel allowed for cooling down the burn injury, reduce pain and improve the casualty's comfort. The use of the Burn-Tec dressing prevents the gel from getting to the airways, which confirms the safety of using such dressings.

The use of hydrogel dressings for other injuries was observed. It is possible owing to the stability of hydrogel. With limited amounts of dressings, this feature proved to be very useful. Semiliquid hydrogels are dedicated only to dressing burn injuries, which narrows down the scope of their applications in the rescue area.

Modelling of the dressing (adjustment to the size and shape of the injury) and next applying a bandage on it did not change its properties. The gel was not absorbed by the dressing and was not squeezed out of it.

## Summary

Rescue actions during mass-casualty events is a very difficult task. One needs to be aware that the achievement of results comparable to those observed in routine actions is impossible.

The introduction of new solutions to rescue services allows for solving further problems. The introduction of hydrogel dressings allows for cooling down and protecting burn injuries if there is no access to water. It is of particular in a mass-casualty incident in which the number of resources is severely limited. It allows for

preventing the destructive action of high temperatures and limits damage to tissues. In this way, it influences the factors conditioning the severity of burns in every age group.

The application of hydrogel in stable form seems easier and safer as compared to liquid form. Owing to absorptive properties, the dressing allows for removing some impurities from the injury. In this way, it can be easily separated from the injury without leaving the gel in it, thus facilitating further procedures under hospital conditions.

The use of hydrogel dressings in the form of stable gel is justified during mass-casualty incidents. These dressings ensure quick and safe cooling and protect burn injuries when no adequate equipment or personnel is available. □

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