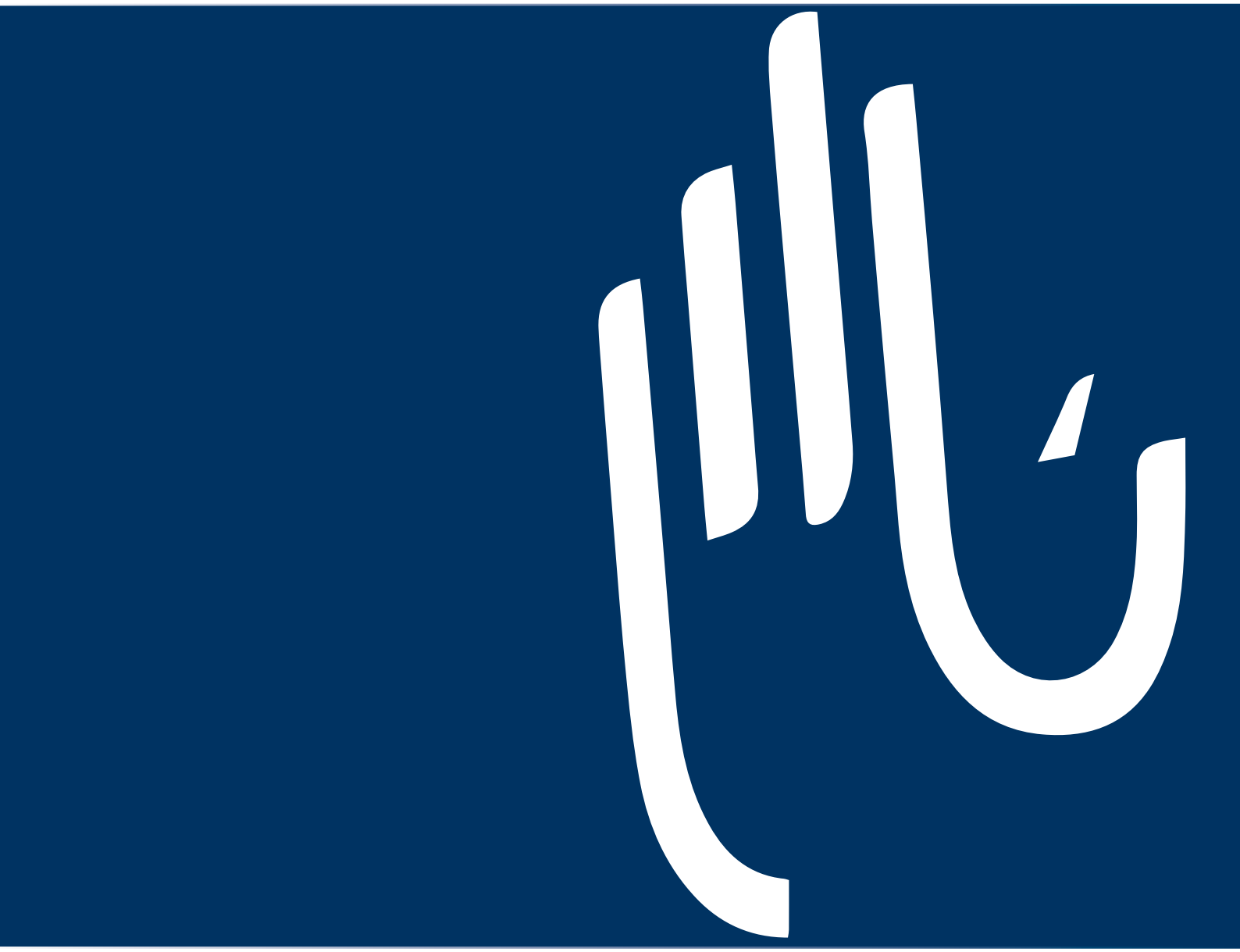
Collection of Practical Guides for Wounds of the Servizo Galego de Saúde

Practical Guide for Burn Injuries. Practical Guide No 5



XUNTA DE GALICIA

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CONSELLERÍA DE SANIDADE

COLLECTION OF PRACTICAL GUIDES FOR WOUNDS OF THE SERVIZO GALEGO DE SAÚDE

PRACTICAL GUIDE FOR BURN INJURIES

Practical Guide No. 5

Xunta de Galicia
Consellería de Sanidad
Servicio Gallego de Salud
Dirección General de Asistencia Sanitaria
2016

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COLLECTION OF PRACTICAL GUIDES FOR WOUNDS OF THE SERVIZO GALEGO DE SAÚDE

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Úlceras Fóra!
Servizo Galego de Saúde

Úlceras Fóra Programme. Servizo Galego de Saúde (Sergas), 2016

PRESENTATION

Everyone knows that the approach to ulcers and wounds implies a health problem of great magnitude due to the extra financial cost it means for sustainability of the health system, due to the loss of quality of life in patients, due to the impact that it has on their families and carers, and also by the workload and clinical variability that their care represents for healthcare professionals.

From the Servizo Galego de Saúde (Sergas), and more intensively from the General Sub-Directorate for Care Management and Organisational Innovation through the Health Care Integration Department, there is an awareness of the importance and impact of a proper management of the prevention and treatment of this type of lesions; so for several years we have been working to improve the structure, resources and conditions required, to try to normalise and systematise the care activity arising from this care process.

Through the **Úlceras Fóra Programme** the reference framework to develop and establish strategic lines in the approach of everything related to ulcers and wounds, one of the basic objectives proposed was to set common care criteria (to identify the risk, assess the lesions, establish preventive measures, establish treatments, use of products, monitoring, registration, etc.) which allow us to move towards the standardisation of criteria and a corresponding reduction in the clinical variability for this type of lesions.

That is why this **Collection of Practical Guides for Wounds from the Servizo Galego de Saúde**, describes the effort and enthusiasm of many professionals (doctors and nurses) to improve their clinical practice in the care and comprehensive approach to patients affected by ulcers and wounds, or at risk of suffering them, in order to incorporate the best available evidence to achieve an improvement in the patient's quality of care and safety.

Jorge Aboal Viñas
General Director of the Health Assistance Department
Servizo Galego de Saúde

PREFACE

This Practice Guide was developed with the participation of health professionals in primary care and hospital care of the Servizo Galego de Saúde (Sergas) and reviewed by expert professionals and scientific institutions at national level, under the coordination of the General Sub-Directorate for Care Management and Organisational Innovation and Direction of Sanitary Assistance of Sergas.

The recommendations for clinical practice based on evidence that are included in this guide are of a general nature and therefore do not define a single course of conduct to be followed in a procedure or treatment for the integral care that is intended to be carried out. Any amendment or variation of the recommendations set forth herein, shall be based on clinical judgement (internal evidence) of the health care professional who applies them and the best clinical practices of the time; as well as the specific needs and preferences of each patient in particular; the resources available at the time of the sanitary attention and in the regulations established by the institution or health centre where they are intended to be applied.

DISSEMINATION AND IMPLEMENTATION

The dissemination and implementation strategy of this practical guide; as well as, of the entire Collection of Practical Guides on Wounds of Sergas, shall be co-ordinated through the Technical Management of the Úlceras Fora Programme; that is to say, by the Health Care Integration Department, of the General Sub-Directorate General for Care Management and Organisational Innovation, of Sergas.

The diffusion process entails a ceremonial presentation at the Consellería de Sanidade of the Xunta de Galicia, the official presentation in all public institutions in the Sergas Healthcare Network, the dissemination of an official statement to the media, its disclosure in scientific events and dissemination on the Internet through the official website of Sergas.

VALIDITY AND UPDATE

The guide should be reviewed after 3 years from the date of its publication. Its updating can be performed before the end of this period if any of the recommendations of evidence modify its categorisation which may lead to a clinical risk of safety for the patient and / or affect the quality of care.

DECLARATION OF CONFLICTS OF INTEREST AND EDITORIAL INDEPENDENCE

The authors of this practical guide declare to have made an effort to ensure that the information contained herein is complete and up to date, and state that they have not been influenced by conflicts of interest that could change the results or contents during the preparation stage and its development. Likewise, the authors of the guide assume responsibility for the content expressed, which includes evidence and recommendations.

The editors of the Collection of Practical Guides for Wounds of the Servizo Galego de Saúde (Sergas) declare that there is editorial independence regarding the decisions taken by the technical management and the coordinators of the working group.

ASSESSMENT AND CLASSIFICATION OF THE EVIDENCE

The scientific evidence and recommendations set forth in this Practical Guide were the result of the assessment and analysis of the sources of information consulted as bibliographic reference (clinical practice guides, guides based on the best evidence, other documents based on evidence, systematic reviews and original articles); the critical reading method and consensus by nominal group between authors and panel of experts was used to prepare it.

The classification of the level of evidence and grading of the recommendations has been maintained while respecting the original source consulted and the scale of evidence that has been used. The method that CENETEC (National Centre of Technological Excellence in Health) of Mexico in the development of their clinical practice guidelines (GPC) has been used for this:

- Classify with the symbol **[E]** that evidence which is published in any GPC, followed by its alphanumeric classification (quality of the study, if it is referenced) and bibliographic citation.
- Categorise with the symbol **[R]** those recommendations identified by any GPC, followed by their strength of recommendation (by A-B-C-D levels, in descending order according to clinical importance, or by their grading in high-moderate-low evidence).
- Identify with the symbol **[GP]** those actions and / or activities considered as good practices, which are not referenced or supported by any GPC, but that appear in other documents based on the evidence (guides to good clinical practice, clinical pathways, protocols based on evidence, etc.) and whose evidence has been obtained through systematic reviews, meta-analyses, clinical trials, etc.

The scales on the level of evidence and degree of recommendations that are described in the contents of this practical guide can be consulted through the bibliographic sources referenced in the summary table of recommendations / evidence.

PRACTICAL GUIDE FOR BURN INJURIES

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Collection of Practical Guides for Wounds of the Servizo Galego de Saúde

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01 LIST OF AUTHORS, COORDINATORS AND REVIEWERS

TECHNICAL MANAGEMENT

Úlceras Fóra Programme
Health Care Integration Department. General Sub-Directorate for Care Management and Organisational Innovation. Directorate General of Health Care. Servizo Galego de Saúde (Sergas)
programa.ulceras.fora@sergas.es

WORKING GROUP

AUTHORS OF THE GUIDE

María Pilar Casteleiro Roca
Specialist Doctor in the Plastic Surgery, Reconstruction and Burns Department at the University Hospital Complex of A Coruña. Organisational Structure of Integrated Management of A Coruña.
Javier Castro Prado
Primary Care Nurse “Plaza de Ferrol” Outpatient Health Centre, Lugo. Organisational Structure of Inte-grated Management of Lugo, Cervo and Monforte de Lemos.

COORDINATORS OF THE COLLECTION OF GUIDES

José María Rumbo Prieto
Supervisor for Care, Research and Innovation. University Hospital Complex of Ferrol Organisational Structure of Integrated Management of Ferrol.
Camilo Daniel Raña Lama
Nurse Labañou Health Centre Organisational Structure of Integrated Management of A Coruña.
María Blanca Cimadevila Álvarez
Head of the Health Care Integration Department General Sub-Directorate for Care Management and Organisational Innovation. Directorate General of Health Care. Servizo Galego de Saúde (Sergas).
Ana Isabel Calvo Pérez
Technician of the Health Care Integration Department General Sub-Directorate for Care Management and Organisational Innovation. Directorate General of Health Care. Servizo Galego de Saúde (Sergas).
Josefa Fernández Segade
Technician of the Health Care Integration Department General Sub-Directorate for Care Management and Organisational Innovation. Directorate General of Health Care. Servizo Galego de Saúde (Sergas).

REVIEWERS

Panel of experts

- **Group of Trainers and Guides in Wounds for the Úlceras Forá Programme of Sergas**
- **Francisco Pedro García Fernández**
  Nurse Coordinator of the Care Strategy Unit Hospital Complex of Jaén.
- **Teresa Segovia Gómez**
  Nurse. In charge of the Multidisciplinary Unit for Pressure Ulcers and Chronic Wounds. "Puerta de Hierro" University Hospital Madrid.
- **Carmen Outón Dosil**
  Nurse. University Hospital Complex of A Coruña Organisational Structure of Integrated Management of A Coruña.

Scientific Institutions and Societies

- **Grupo Nacional para el Estudio y Asesoramiento en Úlceras por Presión y Heridas Crónicas (GNEAUPP)**
- **Asociación Nacional de Enfermería Dermatológica e Investigación del Deterioro de la Integridad Cutánea (ANEDIDIC)**
- **Sociedad Gallega de Heridas (SGH)**
- **Asociación Española de Enfermería Vascular y Heridas (AEEVH)**
- **Sociedad Española de Heridas (SEHER)**
- **Sociedad Gallega de Cirugía Plástica, Reparadora y Estética (SGCPRE)**
- **Federación de Asociaciones de Enfermería Comunitaria y Atención Primaria (FAECAP)**
- **Asociación Gallega de Medicina Familiar y Comunitaria (AGAMFEC)**
- **Sociedad Española de Médicos Generales y de Familia (SEMG)**
- **Academia de Enfermería de Galicia**
- **Colegio Oficial de Enfermería de Lugo**
- **Colegio Oficial de Enfermería de A Coruña**
- **Colegio Oficial de Enfermería de Ourense**
- **Colegio Oficial de Enfermería de Pontevedra**

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02 INTRODUCTION

2.1. JUSTIFICATION

The approach to chronic ulcers and wounds implies a health problem of great magnitude due to the extra financial cost it means for the health systems, due to the loss of quality of life in patients, due to the impact that it has on their families and carers (which in many cases have to take on the prevention and caring), and also by the workload that their care represents for healthcare professionals. Therefore, the decision-making regarding its approach requires taking into account several alternatives from a variety of information sources (clinical data, professional experience, preferences of the patient, scientific evidence, protocols, guides, etc.) which in turn causes a considerable variability of decisions based on the time, the information available and the person who decides. This gives rise to a great disparity in the performance of the professionals in techniques, tests, and diagnostic skills, clinical judgement and decision-making when facing the same problem or patient and even in a same professional in relation to patients with the same clinical and pathology.

This *Practical Guide to Burn Injuries* (Practical Guide No. 5) is integrated into the Collection of Practical Guides of Wounds of the Servizo Galego de Saúde (Sergas); in accordance with the strategies and lines of action promoted through the Úlceras Fora Programme coordinated by the General Sub-Directorate for Care Management and Organisational Innovation. In turn, such a Collection is aligned in line with strategy No. 10 (Improving Clinical Practice), of the Quality Plan for the National Health System 2010, as well as, with Sergas Strategy 2014: Public health at the service of patients.

This guide is therefore meant as a synthesis of the best interventions and preventive or therapeutic practices available for the care of adults with a burn injury; according to the clinical practice based on the most current evidence.

2.2. SCOPE AND OBJECTIVES

The scope of The Guide is addressed to people affected, informal carers and all health professionals with direct or indirect responsibility for the integral approach of burn injuries, in any of the three health care levels in the Community of Galicia: Primary Health Care, Hospital Care and Socio-Health Care.

The aim of the Guide is to provide guidelines and/or standardised criteria to serve as a reference to identify risk factors, perform specific actions of prevention, detection, referral and treatment, which burn injuries pose as a health problem. The aim is to contribute to the welfare of people, reduce the variability of treatments and professional uncertainty, reduce the prevalence and incidence of this health problem in society, as well as achieve greater optimisation in the management of human and economic resources available from the Galician health and socio-health care system based on the recommendations of practice based on evidence and; to attain a few quality care indicators for the care and safety of patients that shall allow for greater efficiency of the process between the different care levels.

2.3. QUESTIONS TO BE ANSWERED BY THIS PRACTICAL GUIDE

- What are burn injuries and how are they defined?
- What is their epidemiology and pathogenesis?
- What type are they and how are they classified?
- What are the most frequent locations?
- How to diagnose a burn injury?
- What measures must be implemented for a proper healing?
- What treatments and/or therapeutic measures are most appropriate?
- What complications can occur?
- What prevention recommendations are the most indicated?
- What treatment recommendations are best?
- What therapeutic guidelines and health education should patients, informal carers and professionals follow to facilitate their care?

03 DEFINITION[1]

Burns are lesions that are produced in living tissues, due to the action of different physical agents: flames, liquids, hot objects, radiation, electric current, cold, chemicals (caustic) and biological products; that cause changes ranging from a simple erythema to the total destruction of dermal and subdermal structures.

04 EPIDEMIOLOGY[2, 3]

About 120,000 individuals suffer from some type of burn each year in Spain and only 5% need hospital care. Mortality data are around 200 people a year, including patients of all ages.

Between 60% and 80% of the burns occur in the domestic sphere and between 10% and 15% in the work environment, with explosion and flames being the main mechanisms, followed by electrical and chemical burns. Within domestic burns the most frequent are those produced by hot liquids (scalding), especially by water and oil, followed by hot solids (iron, stove).

The stages of the life where the greatest number of burns are produced are old age and infancy. For example, in our country 5% of household accidents are caused by ingestion of caustic substances. In Galicia this type of injury in children represents 4.8%.

05 CLASSIFICATION[4, 5, 6]

5.1. ACCORDING TO DEPTH: the depth of the lesion refers to the various layers of the skin and other subcutaneous tissues affected, it indicates the degree of a burn. The degree alone is not synonymous with seriousness.

5.1.1. Epidermal burn (1st degree): the injury partially affects the epidermis.

SIGNS	SYMPTOMS	PROGNOSIS
• Erythema. • No phlyctenae. • Hot and dry skin. • No exudate.	• Pain: from mild to severe. • Hypersensitivity. • Sensation of itching, stinging/burning.	• Healing in less than a week. • Without scar, except complications.

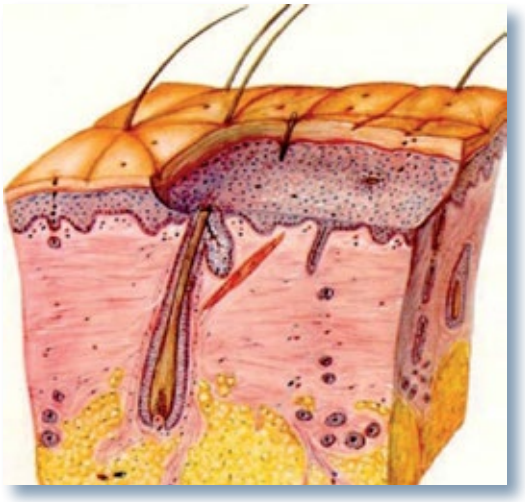

Figure 1

Photo 1. **1st degree burn**
Courtesy of **Josep Petit**

5.1.2. Superficial Dermal Burn (2nd degree superficial): the injury affects all epidermic layers, reaching the papillary dermis. Does not affect the reticular dermis or the root of the pilosebaceous follicles. Islets of epithelial cells remain in the epidermal ridges and in the interior of the glands and follicles to facilitate re-epithelialisation. **(Photo 2)**.

SIGNS	SYMPTOMS	PROGNOSIS
• Flictenas. • Lecho de la herida color rojo intenso o rosado. • Muy exudativa. • Tracción del pelo negativo.	• Hyperaesthesia. • Tend to be very painful, especially when handling.	• Healing: between 7 to 14 days. • Just leave slight temporary dyschromia.

Figure 2

Photo 2. **2nd degree superficial burn**
Courtesy of **Josep Petit**

5.1.3. Deep Dermal Burn (Deep 2nd degree): the injury affects all epidermic layers, reaching the reticular dermis. Does not affect the subcutaneous tissue. There are only some viable epidermal cells that are part of the sweat glands and the pilosebaceous follicles. The superficial sensitive terminations are destroyed. **(Photo 3)**.

SIGNS	SYMPTOMS	PROGNOSIS
• There may be phlyctenae. • Surface of the wound pale red or white, smooth, shiny and exudative. • Positive hair traction.	• Pain. • Less painful on examination than superficial dermal lesions.	• Epithelialisation between 15 days and 3 months. • Significant sequelae. • If they do not epithelialise within 15 days, refer for surgery. • Treatment: debridement and skin autograft .

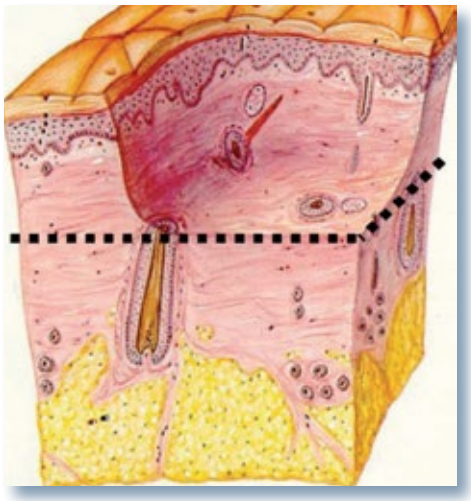

Figure 3

Photo 3. **Deep 2nd degree burn**
Courtesy of **Josep Petit**

5.1.4. Subdermal Burn (3rd degree): complete destruction of the entire thickness of the skin, affects subdermal tissue and other structures (fascia, muscle, tendon, vessels, periosteum). The nerve endings and the annexed skin are destroyed (follicles, glands, etc). **(Photo 4)**.

SIGNS	SYMPTOMS	PROGNOSIS
• Eschar (mummification of burned tissue). • Colour: from pearly white, dark brown to black.	• Anaesthesia, without sensitivity. • Sometimes pain due to compression of underlying planes and due to irritation of adjacent tissues.	• Spontaneous healing is possible only in very small lesions. • Most require surgical treatment with autografts. • Important sequelae (keloids, dyschromia, amputations, retractions), psychological damage.

Figure 4

Photo 4. 3rd degree burns

IMPORTANT

It is very important to note that the assessment of burns in children, especially in children under four years of age, differs significantly from that of adults. Thus, superficial appearance burns are in deeper children. Upon admission, third-degree burns have in children an intense red color (for what could seem of second degree) and the typical white lesions or parchmentthey are almost never seen.

Photo 5. Hair sign

5.2. ACCORDING TO THE AETIOLOGY: the aetiology of the burn is especially important during the first actions, in the urgency and emergency.

5.2.1. Thermal burns: produced by the action of heat.

- **Scalds**: due to hot liquids. Tend to be clean, superficial, but extensive.
- **Flames**: are produced due to direct contact with the flames of a fire. They are dirtier burns.
- **Contact**: the mechanism is hot solids. Tend to be limited and deep.
- **Due to friction**: the burn is caused by the sudden friction of the skin with another surface.

5.2.2. Electrical Burns: they are produced by the direct action of an electric current or heat generated when passing through the tissues. The resistance of each tissue is inversely proportional to the amount of water it contains. They can be:

- **Low voltage (<1.000 V)**, produces little destruction of tissues. Risk of cardiac arrest.
- **High voltage (>1.000 V)**, presents great tissue destruction at the contact points and in the internal structures close to the path of the long bones. They can cause cardiac arrest, alteration of rhythm, fractures, rhabdomyolysis and compartmental syndrome. Cardiac monitoring should be performed and referral to a burn unit.

5.2.3. Burns due to Electrical Flash: a short circuit is usually produced because of the flash. Its treatment differs from the burn produced by electric current.

5.2.4. Chemical Burns: produced by acidic or base substances and corrosive substances that alters the pH of the tissues. The severity of the burn will depend on the nature of the substance and its concentration and the time of contact. They should all be referred to a specialist centre.

5.2.5 Radioactive burns: produced by ionizing radiation (X-rays, gamma rays, etc). and non-ionizing radiation such as solar radiation, ultraviolet, laser, microwave, infrared radiation, etc.

5.2.6. Burns due to cold: the effect of the extreme cold on the tissues produces vasoconstriction and solidification of water from inside the cells, which produces tissue necrosis. The injuries mainly affect acral areas (fingers, ears and nose).

5.3. ACCORDING TO THE EXTENSION: this is the first thing to consider in the assessment of the severity of a burn. On this shall depend the referral to a specialist centre. Moderate and severe burns should be treated in a hospital.

5.3.1. Wallace rule of nines: this is a method that is used to calculate the burned skin extension in a patient. This involves dividing the body surface in areas equivalent to 9% of the total body surface area that is burned (TBSA) or by multiples of 9.

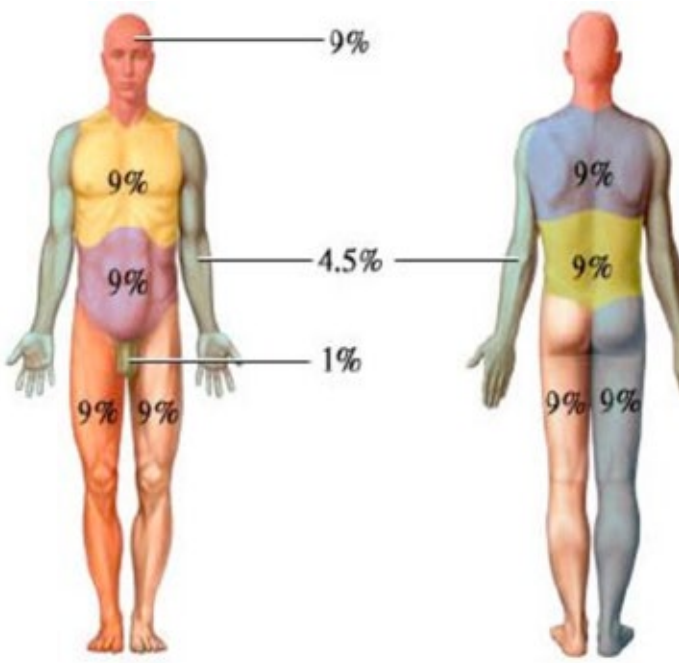

Figure 5. Wallace rule

Source: https://es.wikipedia.org/wiki/Quemadura

5.3.2. Rule of one (Rule of Palm of the Hand): this is a rapid assessment tool to calculate the % TBSA that is burned. The palm of the patient's hand is taken as a reference (fingers together and extended), the surface that can be covered in this way is 1% of TBSA of the patient. This is useful for small areas and as a complementary tool to the Wallace rule.

Photo 6. Rule of one. Rule of Palm of the Hand

5.3.3. Land & Browder Table: in children the proportions of the % of TBSA vary in the different anatomic areas during their growth, with their head being much bigger and the limbs much smaller.

BURNED AREA	0 TO 1 YEARS	1 TO 5 YEARS	5 TO 9 YEARS	9 TO 14 YEARS	ADULTS
Head	19 %	17 %	13 %	11 %	7 %
Neck	2 %	2 %	2 %	2 %	2 %
Anterior trunk	13 %	13 %	13 %	13 %	13 %
rear trunk	13 %	13 %	13 %	13 %	13 %
Buttocks	5 %	5 %	5 %	5 %	5 %
Right arm	4 %	4 %	4 %	4 %	4 %
Left arm	4 %	4 %	4 %	4 %	4 %
Right forearm	3 %	3 %	3 %	3 %	3 %
Left forearm	3 %	3 %	3 %	3 %	3 %
Right hand	2,5 %	2,5 %	2,5 %	2,5 %	2,5 %
Left hand	2,5 %	2,5 %	2,5 %	2,5 %	2,5 %
right thigh	5,5 %	6,5 %	8 %	8,5 %	9,5 %
left thigh	5,5 %	6,5 %	8 %	8,5 %	9,5 %
Right leg	5 %	5 %	5,5 %	6 %	7 %
Left leg	5 %	5 %	5,5 %	6 %	7 %
Right foot	3,5 %	3,5 %	3,5 %	3,5 %	3,5 %
Left foot	3,5 %	3,5 %	3,5 %	3,5 %	3,5 %
Genitals	1 %	1 %	1 %	1 %	1 %
Total	100 %	100 %	100 %	100 %	100 %

Table 1. Land & Brow Table

In a more practical way of assessing a burn extension in children it is assumed that the percentage extension of the head in children under 10 year old is 18% less age and that of the lower limbs is 27% plus the age. **(Figure 6)**.

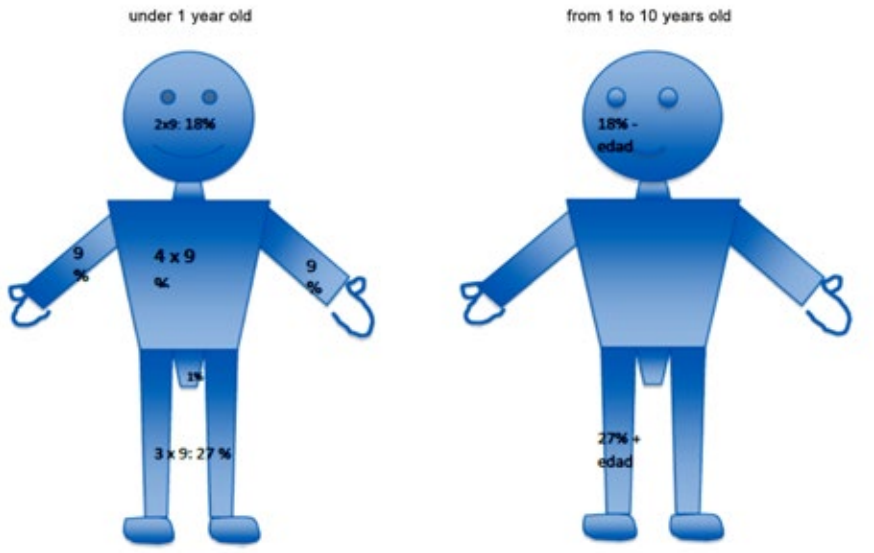

Figure 6. Percentage extension of the head

CHUAC's own compilation

5.3.4. Classification of the Extension of the American Burn Association, adapted

CLASSIFICATION OF BURNS EXTENSION (AMERICAN BURN ASSOCIATION)
MINOR BURN • Second-degree burn, less than 15% of TBSA in adults or less than 10% of TBSA in children • Third degree burn less than 2% of TBSA without affecting special areas (eyes, ears, face, feet, perineum and joints) • Excludes electrical lesions, due to inhalation, concurrent injuries and patients with high risk
UNCOMPLICATED MODERATE BURN • Second-degree burn of 15% to 25% of TBSA in adults or 10% to 20% of TBSA in children • Third degree burn less than 10% of TBSA that does not affect areas of special attention • Excludes electrical lesions, due to inhalation, concurrent injuries and patients with high risk
SERIOUS BURN • Second-degree burns of 25% of TBSA in adults or 20% in children • Third-degree burns greater than or equal to 10% of TBSA • Burns affecting eyes, ears, face, feet, perineum and joints • Electrical burns • Chemical burns in risk areas • All inhalation lesions • Burns with trauma • Burns in pregnant women • Burns in people at high risk: diabetes, lung disease, cardiovascular, immuno-compromising, cancer, AIDS, etc.

06 ATHOGENESIS. PREDISPOSING FACTORS. DIAGNOSIS

6.1. ETIOPATHOGENESIS

The factors that determine the lesion are the intensity of heat, duration of exposure, and conductance of the tissue. The burn produces the following **physiopathological mechanisms**:

6.1.1. SKIN LESION: the burn produces inflammation, which manifests itself in the form of heat, redness, pain, functional impotence and oedema. There is an increase of vascular permeability and vasodilation.

6.1.2. HAEMODYNAMIC ALTERATIONS: the burn produces a loss of skin integrity, which in turn produces loss of capillary integrity, which causes the extravasation of fluid from the intravascular compartment toward the interstice, with the consequent formation of oedema. But the large oedema that occurs due to the burns is not only due to the loss of the capillary integrity, but it is also due to the factors:

- Alteration in the integrity of the microcirculation: as a result of the extravasation of fluid from the plasma towards the interstice and also of proteins. Generally, the oedema formed in a small burn reaches its maximum level between 8 and 12 hours after the injury, in the case of large burns this occurs later, between 18 and 24 hours, because the systemic hypovolemia delays the extravasation of fluid.
- Change of the cellular membrane.
- Increase of osmotic pressure in the burned tissue: Mainly due to the extravasation of sodium from the plasma compartment, which generates hyponatremia.
- Haemodynamic instability: due to notable and early reduction of plasma volume and an increase in the peripheral vascular resistance - and a decreased cardiac output.

6.1.3. METABOLIC ALTERATIONS: the burn produces a series of hormonal changes in the body that produce significant increase of metabolic expenditure and increase of nutritional requirements.

6.1.4. RESPIRATORY ALTERATIONS: the first cause of death in the first few days after the burn is respiratory failure. All levels of the respiratory tract can be affected (larynx, trachea, bronchi and lung parenchyma) due to the effects of constriction and oedema of irritants (smoke) or the direct burn.

6.1.5. RENAL ALTERATIONS: the burn produces hypo-renal perfusion, being the main cause of acute renal failure in the burned patient. Diuresis is a prerenal type in the first hours or days (due to flow deficit), and renal type from the second week (usually due to sepsis, nephrotoxicity, etc).

6.1.6. HAEMATOLOGICAL ALTERATIONS: alteration of the white series (leucocytosis with neutrophilia) and platelets (thrombocytopenia and thrombocytosis).

6.1.7. IMMUNOLOGICAL ALTERATIONS: infection remains the leading cause of death after the first few days post-burn. This is due to the alteration of the mechanical barrier of

the human body (skin and mucous membranes), the loss of protein, and alteration of the body's defence systems (humoral and cellular).

6.2. PREDISPOSING FACTORS

It should be borne in mind that there are special populations, such as children and the elderly. In the case of children, the younger they are in age, the greater the proportion between the body surface area (loss of heat) and total body mass (production of heat), so that the loss of heat is easier and quicker, in addition to not having defence mechanisms to slow down the cold by having an immature thermoregulation system. With regards to the elderly, there is a decrease in the basal metabolism, so that their heat production is less.

6.3. DIAGNOSIS

It is fundamentally clinical. The correct initial assessment of a burn is very important. A proper clinical history should include the following data:

- Personal medical history.
- Date and time of the burn.
- Causal agent.
- Percentage of TBSA (Rule of the 9 or the palm of the hand 1%).
- Degree of the burns.
- Anatomic location of the burn.
- Place where the accident occurred.
- First aid received.

07 GENERAL GUIDELINES FOR TREATMENT EVIDENCE AND RECOMMENDATIONS

7.1. PRE-HOSPITAL CARE[4, 5]

One of the factors that most influence in the reduction of morbidity and mortality of the burned patient is the speed in starting suitable treatment. That is why it is necessary to set up a protocol of interventions outside the hospital to ensure proper attention of the burned patient at the place of the accident, during transport or in the hospital until their transfer to the Burns Unit of reference.

All moderate and severe burns are generally referred. Minor burns (which we can treat outside the hospital environment) can be referred if they are associated with a complex clinical development or are children under the age of 15 years or older adults over 60 years old.

7.1.1. URGENT PREHOSPITAL CLINICAL TREATMENT

All burned patient must be considered as a potential multiple trauma patient. Given that sometimes the burn is a result of an accident that may have another type of injury. So the first thing is to identify and discard the problems that could compromise the life of the patient. This is standardised in the implementation of the so-called resuscitation ABC (since 2013 this has been changed to CAB in the American Heart Association guides); ensuring an adequate cardio circulatory function, airway and respiratory function (see CPR algorithm). **(annex 1)**.

7.1.2. URGENT PREHOSPITAL TREATMENT CONSIDERATIONS[3, 4, 5, 6]

- Always take universal precautions. The potential danger to the rescuer must be taken into account.
- Detain the combustion process.
- Identify the victims, ensure their rescue and place in a safe area as far away as possible from the place of the event and in a safe place with clean air. If necessary request help (fire, ambulance, etc).
- Remove clothing, rings, watches, belts.
- Assessment of the burns. Estimate the BSA (rule of 9, rule of 1).
- Cooling of the burns with whatever is at hand, water, saline solution or water gel dressings (this would be ideal). Avoid possible hypothermia.
- If it is a burn due to a chemical agent continue with irrigation until reaching the hospital centre.
- If it is a victim due to electrical current, disconnect this current before touching the patient. Use non-conductive material.
- Cover the injury with water gel dressings, gauze or towels soaked with saline solution or clean water.
- Not debride the phlyctenae until reaching an appropriate place (hospital, health centre), except in burns with a chemical aetiology.

7.1.3. LOCAL TREATMENT OF BURNS[4, 5]

- **1ST DEGREE (EPIDERMAL):**

CARE OF THE WOUNDS	EVIDENCE LEVEL
Do not apply very cold water.[7]	Low.
Moisturise the skin.[8, 9]	Low.
Protection from the sun during 15-30 days.[5]	Low.

The objectives of **cooling** are: to neutralise the action of the causal agent (slow down the heat action, dilute and drag the chemicals), relieve pain; decrease the release of inflammatory mediators.

The use of cold water or saline solution produces vasoconstriction and accelerates the deepening of the lesion, as well as an increased risk of hypothermia. A temperature of 18- 20º should be used (ambient temperature). The area should be irrigated or immerse the affected area or by placing a soaked clean gauze or cloths over the affected area. Water gel dressings are the best option in burns of thermal origin, unlike the rest of the dressings they calm the pain quickly, do not adhere and also prevent hypothermia, due to their diving suit effect.

The hydration of the skin using creams, oils or gels, is the best way to recover the skin's dehydration produced by the burn. Apply several times a day to avoid skin dryness.

- **2ND DEGREE SUPERFICIAL-DEEP (DERMAL) and 3RD DEGREE (SUBDERMAL):**

CARE OF THE WOUNDS	EVIDENCE LEVEL
Rinse with potable water or saline solution.[10]	Moderate.
Do not use very cold water.[7]	Low.
Dry the lesion without rubbing the area.[11]	Low.
If an antiseptic is necessary, use chlorhexidine digluconate.[5, 12, 13]	Moderate.
If an antiseptic is necessary, use chlorhexidine digluconate.[5, 14]	Low.

Regarding **cleaning**, current evidence indicates that there are no significant differences between washing the burn with potable water, water with soap or physiological serum. Only where there is visible dirt or high risk of infection (major burns), is cleaning with soap and water or a broad spectrum antiseptic (chlorhexidine 1 or 2 %, or polyhexanide solution 0.1% plus undecilenamidopropil betaineto at 0.1%) indicated. Always at room temperature. After washing the area must be dried without rubbing to prevent damage to the viable tissues.

The phlyctenae must always be **debrided** because they can become contaminated from the bacterial flora itself present in the skin appendages. If it is not debrided and the

denatured epidermis is not removed, a correct assessment of the burn cannot be made. On the other hand, the fluid that is in the phlyctena can exert pressure on the wound bed and the burn can continue to deepen. If we leave the phlyctenae and we do not debride the dead epidermis, when applying antimicrobials via topical route, they will not be able to act in the wound bed. To debride the phlyctenae we can do this with tweezers and pull the devitalised epidermis towards the edge until it breaks. On the palms of the hands and soles of the feet, it is necessary to use surgical material, since the epidermis is much thicker.

Burns should not be rubbed or brushed because:

- Pain, bleeding is produced, and germs are spread.
- The viable epithelial cells are destroyed which are going to be of help for a faster reepithelialisation and for better aesthetic quality.

Once the cleaning and debridement of the denatured tissue has been completed, the burn shall be properly assessed and will be covered with the best dressing for that moment.

7.1.4. PREHOSPITAL TOPICAL TREATMENT[4, 5]

Recent studies show a better evolution, lower cost and a lower incidence of infection when covering with dressings of a moist healing environment (MHE). However, in certain circumstances, (orography of the area, lack of suitable material), the application of ointments such as silver sulphadiazine at 1%, may be a good option.

There is no single or specific product, but it shall depend on several factors:

- Characteristics of the burn (extension, depth, ethology, location).
- Amount of exudate from the burn.
- Evolutionary stage of the burn.
- Easy to adapt.
- Non-traumatic when removed.
- Availability of material.

If there is a risk of infection or signs of critical colonisation or infection (bad smell, cellulite, purulent exudate, etc), or we are dealing with risk patients, we have dressings with ionic silver, silver nanocrystalline. Other dressings available have honey, based on adsorption by intra molecular attraction, dressings with iodized cadexomer, etc. These are often dressings that exert a more durable and effective effect than usual ointments.

RECOMMENDATIONS	EVIDENCE LEVEL
In second-degree burns without risk of infection it is not necessary to apply topical antimicrobials.[15]	Moderate.
There is not enough evidence on the effectiveness of a dressing over another.[11]	High.
Use dressings with low and adaptable adherence.[17]	Moderate.
Hydrocolloid dressings are suitable for the management of exudate in superficial burns.[13, 18]	Moderate.

Hydrocellular dressings have higher absorption capacity that hydrocolloid ones.[19]	Low.
Dressings with silicone protect the perilesional and epithelialised skin.[20]	Moderate.
The topical antibiotic of first choice in second- and third-degree burns, is silver sulphadiazine.[10, 21, 22]	Moderate.
In third-degree burns sulphadiazine should be applied with cerium nitrate.[13, 21, 22, 23]	Moderate.
Silver dressings can help reduce the need for dressings and the average hospital stay.[16]	Moderate.
Silver dressings, compared with sulphadiazine, reduce pain in the dressings.[27]	Moderate.
Do not use systemic antibiotics preventively in minor burns.[28]	Very low.

Hydrocolloid dressings are not recommended to be used in deep burns. A hydrocellular dressing with selective and little aggressive adhesion with the wound bed provides adequate coverage to cover superficial burns in the most exudative stage (2-5 days). Afterwards a thinner dressing, either hydrocellular or hydrocolloid, or a hydrogel sheet, shall give a good coverage.

SILVER SULPHADIAZINE is the most used topical agent used in burns units. It combines the action of sulphonamides and silver. It is effective against gram positive and gram negative, being a fungicide against Candida. Resistors can be seen. The addition of cerium nitrate to sulphadiazine eliminates the resistors. Its activity is short in exposed healing, in occlusive healing; a generous layer of the preparation silver sulphadiazine cream with cerium nitrate can be effective for up to 24h, although it is recommended to change it every 12 hours in extensive deep burns. It has the capacity of penetration in the eschar. Adverse effects are very scarce.[3]

Silver dressings are an option in the treatment of the bacterial load of the injury. Silver is quite safe, it has a broad spectrum action, low toxicity, and hypersensitivities are rare. It is often used in children, since they often cooperate very little, due to convenience and requiring a lower frequency of dressings.

The use of SYSTEMIC ANTIBIOTHERAPY as prevention is NOT recommended in any type of burn (even in electrical), given that there is no evidence that it improves the prognosis and can create resistance.

7.1.5. OTHER PREHOSPITAL CARE

SKIN CARE	EVIDENCE LEVEL
Moisturise the skin.[5, 8, 9, 29]	Moderate.
Use sunscreen products.[5, 8, 9, 29]	Moderate.

The use of sunscreen products is required in already epithelialised areas to avoid dyschromia. The product to apply should be effective against ultraviolet radiation type A and B. There is no sun protection product that can filter all ultraviolet radiation.[29] Ideal products are those of high or very high protection. A protection factor of 50 is recommended.[30] Injured areas must be protected from the sun for a year and a half from healing. Times when the sun is most powerful should be avoided.[31]

EYE CARE	EVIDENCE LEVEL
Clean eyes several times a day.[22]	Very low.

If the eye presents too much pain, exudate, ulceration or other pathology it must be referred to ophthalmology.

MOUTH CARE	EVIDENCE LEVEL
Use chlorhexidine 0.12% as antiseptic.[32, 33, 34]	Moderate.
Use barrier products of the mucosa and protective agents of the mucosa.[34]	Very low.

Chlorhexidine is the antimicrobial of choice to prevent infection in the oral cavity.[33] Mucosal barrier products form a film in the mucosa by relieving the pain in the states of inflammation.

PAIN MANAGEMENT

The pain can be severe at the beginning and at different levels during the healing process. Superficial dermal burns are usually the most painful. There is no consensus at national level in the management of pain. Its management will depend on the team responsible. In general paracetamol and/or NSAIDS every 8 hours or every 4 hours and alternating medications tend to be sufficient.

NUTRITIONAL CARE	EVIDENCE LEVEL
Evaluate the state of nutrition individually and continuously until healed.[35, 36]	High.
It is recommended that the caloric intake does not exceed 200% of the estimated energy expenditure.[36]	High.
Burned patients will receive a high protein intake.[36]	High.
The preferential use of enteral nutrition is recommended.[36, 37, 38]	High.
Enteral nutrition should be administered early.[38, 39]	Moderate.
A glucose intake is recommended.[36, 37]	High.

Thermal aggression alters the histology, physiology, biochemistry and immunology of the skin, underlying tissues and even organs far away from the primary injury; it affects the nutrient microcirculation of these structures, causes immunosuppression and organic insufficiency, and can trigger Systemic Inflammatory Response Syndrome. These events cause an increase in metabolic demands of the patient, affect the body composition and cause serious nutritional disorders.[36]

About 20% to 25% of the caloric intake should be provided in the form of protein. In patients who cannot eat, by mouth, 75% of the caloric and protein needs, should be administered by feeding tube.[39]

The glucose administered in the nutritional support may decrease the intensity of the neoglucogenesis and curb the protein catabolism, preserving part of the lean muscle mass.[37]

CARE OF THE BANDAGES
Fingers must be dressed individually, to avoid the adhesion between them.[3, 22] **Low Evidence**.
Elastic or cohesive bandages will be used to allow the expansion of physiological oedema. The ideal is elastic tubular mesh.[3, 5]
Cotton edged bandages shrink with moisture and put pressure on the lesion, causing the deepening of the injury.[3, 5]

OTHER CARE
In the initial stage, the burned area must be rested and raised.
In the case of burns, walking to activate circulated is not suitable. Here what is harmful is the increase of oedema by gravity drip and the orthostatic pressure of the blood in the capillaries in the formation process (neoangiogenesis).[5]
If the injury affects joints, in the synthesis stage (3-5 days), the limb concerned should be kept in hyperextension.[4, 5]
When it affects the lower limbs, compression bandages or stockings should be worn when starting to walk, to avoid the vascular stasis in the scarring area.[4, 5]
When hypertrophic and disabling scars remain, elastic garments can be applied (pressotherapy) and silicone masks, which are made to measure.[4, 5]
Check the status of tetanus immunisation.

7.1.6. RECOMMENDED MATERIAL TO CARE FOR BURNS

This can mainly divided mainly in:

7.1.6.1. MOIST HEALING ENVIRONMENT DRESSINGS (MHE)

In our community we have a catalogue with 32 varieties of MHE dressings we are going to see their use in burns by families:

PRODUCT	CHARACTERISTICS	INDICATIONS
ALGINATES	High absorption capacity Haemostatic.	Very exudative 2nd degree burns. Requires secondary fastening.
HYDROGELS	Water content. Improves enzymatic and autolytic debridement.	In A&A it cools and relieves pain.
POLYURETHANES	Exudate absorption and retention. Semi-permeable adhesives and non-adhesives. The silicone ones are low-adherence.	2nd degree burns. The silicone ones respect the already epithelialised tissue, apply on lesions with good granulation tissue.
HYDROCOLLOIDS	Absorbent gel formers.	2nd degree superficial burns. The superfine is ideal in final stages of epithelialisation.
HYDROCOLLOIDS WITH HYDROFIBRE	High absorption capacity. Gel former.	Exudative 2nd degree burns. Requires another retaining dressing.
ANTIMICROBIAL	Wide spectrum bactericides. Silver releasing and non-releasing.	2nd degree burns with risk or signs of infection.
INTERFACE MESHES	They are hydrophobic. Protect the wound bed and newly formed tissue.	Superficial burns. Sometimes with a mesh and gauze this is sufficient Deeper burns with granulation tissue.
WITH IONIC CHARGE	Bioactive with Zn^{+}, Mn^{+} and Ca^{+}. Stimulate healing.	Lesions in the granulation and epithelialisation stage.
MATRIX METALLOPROTEINASES MODULATORS (MMP)	Modulates the action of the MMP. Recovers the healing activity.	Burns that are free of necrotic and infected tissue, present a significant delay in healing.

7.1.6.2. OINTMENTS AND CREAMS

Silver sulfadiazine: in second and third degree burns, when there are no other materials or the orography of the burn requires it. In expository cure apply every 8 or 12 hours. With occlusive dressing should be every 12 hours.

Silver sulfadiazine with cerium nitrate: third-degree burns. Cerium allows a great insight into the slough. Cures every 24 hours

Collagenase: removes devitalized tissue. If there's no exudate, hydrogel must be provided to enhance its action.

Moisturizers: moisturizing products will serve to restore and maintain the skin, and to prevent itching.

Sunscreen products: to protect epithelialized areas and avoid discolorations.

Antiseptics

Chlorhexidine: the antiseptic of choice because of its broad antimicrobial spectrum, being active against gram +, gram - and spores. Its activity is rapid and has a lasting action. Its side effects are rare due to their negligible skin absorption. It is used in dirty or at risk of infection burns, even in severe burns. Moreover, it is the antiseptic of choice in burns of the oral cavity.

7.2. HOSPITAL CARE

7.2.1. URGENT HOSPITAL CLINIC CARE

As has already been specified throughout this subject, we must consider that any burned patient is potentially a multiple trauma patient, taking into account that there may be another type of injury. So the first thing is to identify and discard the problems that could compromise the patient's life, applying the so-called resuscitation ABC:

- **Airway:** an orotracheal intubation must be carried out when there is suspicion of upper airway obstruction or in patients with extensive burns. The upper airway is affected by the local thermal effect and by oedema. The signs that indicate thermal injury are the burning of nasal whiskers, burns on the lips or in the oropharynx mucosa, productive coughing, hoarseness and stridor.

- **Respiratory function** : saturation > 98% must be ensured. In extensive burns administer oxygen at 35%. If there was exposure to gases and smoke, administer humidified oxygen, at between 50%- 100%. In all other cases administer oxygen at 28% - 35%.

- **Spinal cord injury**: cervical and back immobilisation until the non-existence of injury is proven.

- **Circulation**: the burns affecting > 20% BSA produce cardiovascular changes known as "shock by burn". Their initial pathophysiology is due to the loss of plasma from the intravascular space toward the interstitial space.

- **Resuscitation/PACU**: tries to avoid the shock by burn. In general, the objectives of resuscitation are:
  - Maintain the perfusion of vital organs and prevent the development of multiple organ failure.
  - Restore the loss of fluid seized in the burned tissue and, to a lesser extent, in the healthy tissue.
  - Provide the least amount of fluid volume necessary to maintain adequate perfusion of the organs (the fluid accentuates the oedema).
  - Replenish sodium plasma losses, produced by the passage of this towards the burned tissue and the intracellular space.
  - Avoid solutions containing dextrose in adults and older children, since that would imply their total excessive and harmful contribution. An exception is small children, whose glycogen deposits are very scarce and require an extra contribution of carbohydrates.
  - In general the fluids that contain salt at least in isotonic quantities with the plasma are suitable for use in resuscitation, as long as they are provided in the right amount.
  - The resuscitation ends when the oedema formation ceases, which usually occurs between 24 and 48 hours after the burn. We cannot forget, from that moment, the replenishment of the daily loss of fluids that occurs through the burn.

- The most used replenishing fluid is RINGER LACTATE, because its composition is similar to that of extracellular fluid, and lactate is a source base due to its conversion to bicarbonate in the liver. Formulas with glucose should be avoided (except in young children). Fluids like hypertonic saline solution have been associated with increased incidence of acute renal failure and to higher mortality and should not be used on a routine basis. Colloids are not effective in the first 8 hours after the burn.
- Calculation of the amount of fluid, the least amount of fluid volume required to maintain adequate perfusion of the organs must be given. The non-invasive parameter that best reflects the perfusion of organs is the diuresis, which is considered acceptable when it reaches a minimum of 0.5-1 ml/kg/h in adults (more than 1 ml/kg/h if the burn is electric) and 1 ml/kg/h in children (for children under 30 kg). The PARKLAND FORMULA is used to start the fluid infusion: RL = 4 ml / kg / % BSA in the first 24 hours - half should be administered in the first 8 hours, and the other half in the following 16 hours. This calculated volume is only indicative to start the infusion, adjusted subsequently in the light of the diuresis (needs can be higher in the case of smoke inhalation, delay in the resuscitation or hypovolemia).
- Type of Vascular Access, the first option should be a peripheral vein in the non-burned area, followed by central vein in a non-burned area, peripheral vein in burned area or as worst option a central vein in burned area. If the patient is haemodynamically unstable, or if it is not possible to obtain blood pressure measurements using a sphygmomanometer because the limbs were be burned, or if frequent extractions are required for blood gases are the arterial route must be attempted by inserting through healthy skin.

- **Physiological measurements**: in general burned patients requiring hospital admission require initial monitoring of:
  - Oxygenation using pulse oximeter.
  - Blood pressure - try MAP (mean arterial pressure) of 70 mmHg.
  - Heart rate (the presence of tachycardia > 130 bpm usually indicates need of fluids).
  - Urinary catheterisation with hourly diuresis - Objective 0.5 ml/kg/h - the renal blood flow is a reflection of systemic perfusion during the early stage of the burn.
  - Proper balance of inputs and outputs of liquids.
  - Electrocardiography monitoring.
  - Body temperature - trying to maintain a normal temperature.

- **Neurological function**: assessment and reassessment of the level of awareness using the Glasgow Outcome Scale and through pupil assessment.

- **Secondary Assessment**: a physical examination shall be carried out using system-by-system, in addition to identifying associated trauma, researching the patient's previous clinical history, basal life and the characteristics of the thermal trauma that they have suffered.

- **Pain Control**: intravenous must be used preferably, avoiding administration using an intramuscular or subcutaneous route. In general the most commonly used medications are opioids (morphine).

- **Anti-tetanus prophylaxis**: depending on the patient's history of immunisation.

- **Diet**: should always be absolute until assessed by specialist staff. On many occasions it is necessary to put in a nasogastric tube (see nutritional care).

- **Complementary tests**: those which must be carried out are:
    - Arterial blood gas analysis with carboxyhaemoglobin determination.
    - Chest x-ray.
    - ECG.
    - Analytics: blood tests, biochemistry and coagulation.
    - Others.

7.2.2. URGENT HOSPITAL TREATMENT OF BURNS

The first care of the burns consists in washing the patient. If patient conditions permit the dressing is performed in an appropriate bathtub, carrying out washing by drag-out with lukewarm water (in superficial burns of extension less than 10% BSA 0cold water can be used), subsequently washing affected surfaces with mild antiseptic soap. Subsequently the surfaces are rinsed with saline solution or sterile water, the phlyctenae and epithelial remains are debrided and the dressing is completed, which may be occlusive or expository depending on the type of injury.
In the successive dressing of the burned patient washes of the same type shall be carried out together with serial debridement of the burns. As for the first time, the washing of the lesion but be started to remove remains of cream, detritus and non-viable tissues. If a stronger debridement is required then the patient must be sedated. All burn dressings should be carried out under sterile conditions.

In general patients' dressings that require hospital admission must be carried out in an occlusive manner, with burns on the face and perineum being an exception. **(Photo 6)**.

Although in the case of superficial burns the use of topical chemotherapeutic agents is not necessary, in case of burns that require hospital admission, the use of antiseptics is the usual practice. The rationale of this practice is, in trying to avoid infections that cause a significant delay in the epithelialisation than the use of antiseptics. These agents are spread on compresses that are applied directly on the skin.

The choice of a certain preparation for local action is performed depending on the condition of the burn. The rotation of these topical antiseptics is essential to avoid resistance. The frequency of the dressings varies depending on the type of preparation and the local conditions of the burn. The main agents used are:

- **Silver sulphadiazine**: This is the most used topical agent in burns units. It is effective against gram positive and gram negative, being a fungicide against Candida. Its activity is short in expositive dressings, in occlusive dressings, a generous layer of the preparation of silver sulphadiazine cream with cerium nitrate can be effective for up to 24h, although it is recommended to change every 12 hours in extensive deep burns.
- **Chlorhexidine**: broad spectrum antimicrobial, effective against positive gram and negative gram, inhibits germination of the spores, rapid action and sustainable activity. Adverse effects are scarce due to the virtually zero absorption through the skin.
- **Povidone iodine**: the germicide action of iodine is important and includes positive and negative gram and spores, fungi, viruses, cysts and protozoa. Poor penetration in the eschar. Healing can be delayed due to fibroblastic inhibition; can produce cutaneous hypersensitivity and hyperthyroidism.
- **Corticoids**: corticosteroid creams are one of the few topical non antiseptic preparations used in burns. Their use is restricted to superficial burns to control the inflammatory phenomena

and pain, or in the bloody areas with luxuriant growth of granulation tissue, where it is used to reduce this hypergranulation taking advantage of their local vasoconstrictor effect.

- **Others**: gentamycin, nitrofurazone, neomycin, bacitracin, etc.

When performing dressings of burned patients an attempt should be made from the start of the treatment TO PREVENT SEQUELAE, carrying out actions designed to reduce them. Postural treatment with bandages and splints, and collaboration with the rehabilitation service, is essential to reduce joint contractures due to an improper position, reduce shrink scars, synachiae, etc. On the other hand, an adequate surgical treatment will minimise healing by second intention and the possibility of pathological scarring which causes alterations. Finally we have adjunctive treatments used when there has been an epithelialisation of burns (pressotherapy, silicone sheets, etc).

7.2.3. URGENT SURGICAL TREATMENT OF BURNS

When the initial assessment of a burned patient is carried out special attention should be given to the presence of circular burns on limbs, neck or chest. The presence of circular burns in limbs (even superficial) may cause compartment syndrome, compromising blood circulation, even causing muscle necrosis in the affected limb. Special attention should be paid to these burns, with urgent surgical intervention being carried out if necessary. **(Photo 7)**.

Photo 7. **Expositive dressing. Occlusive dressing**

Urgent surgery consists of carrying out decompression escharotomies in the affected areas. **(Photo 8 and 9)**.

Photo 8. **Deep circumferential burn of both lower limbs, which requires urgent surgery**

Photo 9. **Deep circumferential dermal burn in both upper limbs, which requires urgent surgery**

Photo 10. **Decompression escharotomies in upper limbs**

Although most of the urgent surgeries are performed in the extremities, it may also be necessary to perform them on the chest or neck when the airway or ventilation of the patient is compromised.

In the case of deep burns (especially in burns due to electrical trauma) an urgent amputation of the affected limb may be needed.

7.2.4. SCHEDULED SURGICAL TREATMENT IN THE BURNED PATIENT

Scheduled surgery in the patient with burn injuries is the treatment of choice for deep burns. Its objective is to remove the irreversibly damaged tissue and to carry out a final coverage of the wounds.

Surgical debridement of the burn should be done early, but we must ensure the haemodynamic stability of the patient before performing it. This is usually achieved between the 3rd and 5th day after the burn.

Surgical debridement consists in complete excision of the burned tissue. It is not possible to perform complete excision of the burned area in extensive burns, among other factors; due to the excessive blood loss that would occur (2-3 red cell concentrate packages are required per 10% of body surface area to have an excision). Excisions are not usually carried out on more than 25%-35% of the BSA.

In massive deep burns (>60%) the complete excision of the affected tissue cannot be carried out, so areas to be intervened must be prioritised:

- Some authors favour dealing first with functional areas, giving priority to the hands and joints, especially of the upper limb. Then face and neck (for its aesthetic importance) provided that the depth of the lesion is confirmed. The lower limbs would then be next, followed by the chest and abdomen, and finally back, palms and soles.
- Other authors argue that the priority is the excision of the highest percentage of burn possible, starting with any area.
- Each patient requires an individual assessment and prioritisation of areas to operate.

The debridement of burned tissue can be basically of two types:

- **TANGENTIAL DEBRIDEMENT**: tangential removal of burned tissue using dermatome (manual or electric) or hydro scalpel, until the underlying healthy tissue is reached. Produces capillary bleeding, which stops with pressure, electrocoagulation of vessels, and coverage of the debrided tissue.

- **FASCIAL DEBRIDEMENT**: removal of burned tissue until the fascia is reached. Advantages: more straightforward technically, less bleeding and better viability of the plane. Disadvantages: interrupts venous and lymphatic drainage routes, higher aesthetic sequelae, should not be done on the face or perineum requires immediate coverage to avoid desiccation of the tissues. It is performed only in special cases.

The debridement and coverage of an intensely burned patient is performed serially, provided that the haemodynamic condition of the patient permits it. The challenge in the treatment of the intensely burned patient is not the elimination of tissue that is not viable, but its coverage
We have SEVERAL METHODS FOR CUTANEOUS COVERAGE, TEMPORARY OR DEFINITIVE, although none of them is ideal:

- **SYNTHETIC COVERAGE**: with dressings (hydrocolloid, with silver, hydrofibre, etc).

- **BIOSYNTHETIC COVERAGE**:
  - **BIOBRANE**: is the most universally used, made up from a nylon mesh in which purified collagen of porcine origin is intersected together with an external silicone sheet. **(Photo 11)**.

Photo 11. Coverage with Biobrane

  - **COMPLETE:** synthetic dressing which due to its composition facilitates the formation of a neodermis after about three weeks in the recipient bed; the outer layer is replaced by a fine autograft or autologous keratinocyte cultures. This coverage would be indicated in full-thickness skin losses. Its price is very high.

- **AUTOGRAFTS**: this is the best final coverage when the patient has sufficient donor areas:
  - They are applied during the same operation in which the burn debridement takes place.
  - In the first hours after application of the graft an adhesion by fibrin and collagen is produced. In 24-48 hours, the plasma of the receptor bed shall nourish the capillary system of the graft, and between the third and fifth day there is a definitive capillary neovascularisation from the bed.
  - Any unburned skin area (except the face and hands) can be used as donor area.
  - The graft is obtained using a dermatome.
  - The ideal thickness is 0.20-0.25 mm, except for coverage of face, neck, hands and joints where that of increased thickness is preferable, using thinner ones in massive burns in the elderly and children. The greater the thickness of the autograft, the less retraction of it, but greater difficulty that it takes.
  - Grafts can be applied as a sheet or meshed (the sheet graft presents a better aesthetic result but increased frequency of haematoma, the mesh graft presents capacity to cover a greater surface area and less bruising, but presents worse aesthetic appearance, and they do not act as a barrier until the epithelialisation occurs). **(Photo 12)**.

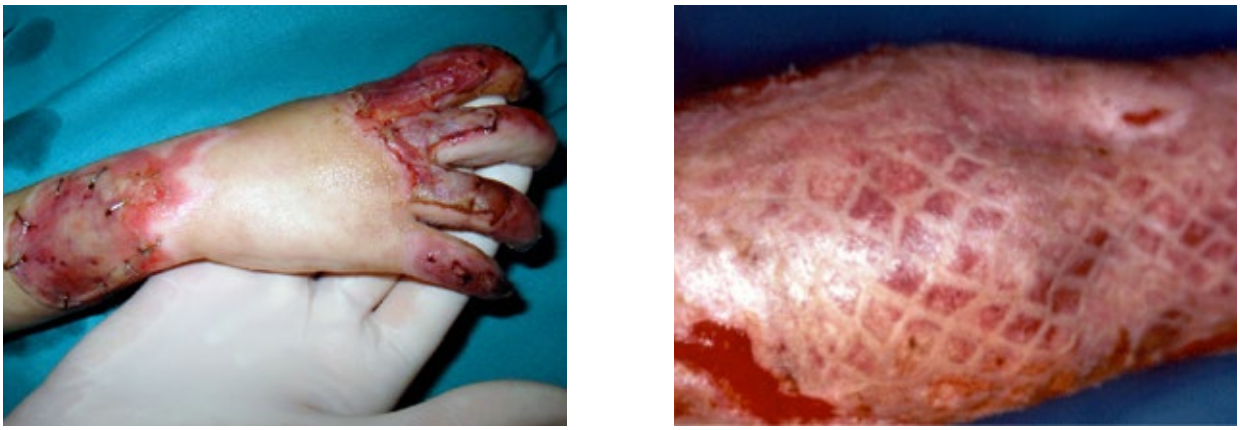

Photo 12. **Skin graft without meshing. Partial meshed skin graft**

- **BIOLOGICAL SUBSTITUTES**: developed in skin banks to solve the problems of cutaneous coverage that major burns pose. There are:
  - Xenografts (pig): limited use, high antigenic capacity that produces rejection in approximately 72 hours.
  - Homografts or allografts Cryopreserved and/or preserved in glycerol - very used. Has a high antigenic power, therefore it is lost in a few days.
  - ALLODERM: another form of skin substitute.
  - Cultivation of Autologous Keratinocytes - large sheets of keratinocytes are obtained which are grown from a biopsy of the patient's healthy skin. This is the first definitive coverage as described for the treatment of patients who do not have sufficient donor areas.
  - Cultivation of Allogeneic Keratinocytes - would act as a neodermis on which a culture of keratinocytes or a fine autograft would subsequently need to be implemented.
  - Autologous and Allogenic Artificial Skin (cultivated compounds grafts) - is the latest coverage being researched, it is a complete skin that is created from fibroblasts and keratinocytes from a biopsy of the patients themselves. These are the ones that are currently creating the most expectations, their fundamental advantage being the only substitute that offers the two components of the skin in a definitive way. Their price is high.

7.2.5. LOCAL INFECTION OF THE BURN

The most effective action to prevent infections in burned patients is the correct handling of the burns: correctly using topical antiseptics, correctly setting out the elimination of thermal surgical lesions covering the bloody surfaces early.

Antibiotic prophylaxis is never administered in the burned patient except in electrical injuries. The clinical suspicion of local infection must be accompanied by microbiologic culture through a skin biopsy (do not carry out cultivation through swabs given their zero effectiveness).

The treatment is then performed starting a more aggressive topical empirical antiseptic treatment: use of broad spectrum antiseptics, increase in the frequency of the dressings…

In the event that the local infection is accompanied by signs of sepsis, broad spectrum empirical intravenous systemic antibiotherapy shall be started until the results of the microbiological cultures are available that allow us to perform specific treatment for each infection.

The germs that are isolated with greater frequency in the tissues with burns are Staphylococcus aureus, *Staphylococcus epidermidis* and *Pseudomonas aeruginosa*.

08 SPECIAL BURNS. TREATMENT CONSIDERATIONS

There is a group of burns that we can consider special due to their action mechanism, and their different behaviour from other burns, being potentially more destructive since that they generate higher haemodynamic and functional alterations than other burns.

8.1. ELECTRICAL BURNS

Electrical burns are thermal burns produced by a very high intensity heat when the victim's body becomes an accidental resistance, producing a cytotoxic reaction. They are the most devastating of all thermal lesions in relation to their size, affecting normally the skin and deeper tissues.

It should be borne in mind that approximately 15% of patients who suffer an electric burn are associated with another type of traumatic injuries in addition to the burn, which is why we usually speak of electrical trauma. Electrical trauma usually affects mainly young males at work, and children in the domestic sphere. They are the most frequent cause of amputations in the Burns Unit.

The damage the electric current causes depends on several parameters: voltage, current (amperage), the type of current (continuous or alternate), the flow path of the current, the duration of the contact, the resistance at the contact point and individual susceptibility.

The different types of electrical trauma refer to:

- **DIRECT ELECTRICAL TRAUMA**: there is passage of electrical current through the body:
  - Low voltage electrical trauma (<1000 V) - constitute approximately 80% of all electrical injuries. They are especially frequent in the child population in the domestic sphere. The burn is usually located in the area close to the injury, which tend to be the mouth and hands. They can cause severe arrhythmia.
  - High voltage electrical trauma (>1000 V) - are burns to the skin of several degrees that are associated with intense destruction of deep tissues that affect multiple organs. It is a trauma that is similar to that produced by a crushing.

- **INDIRECT ELECTRICAL TRAUMA OR VOLTAIC ARC**: are the result of the exit and the re-entry of the current from one part of the body to another, especially in areas of flexing like the wrist, elbows, armpit or popliteal gap.

- **ELECTRICAL FLASH**: A flash burn is produce that should be managed like a flame burn.

- **ELECTRICAL TRAUMA CAUSED BY LIGHTNING**: the typical skin manifestation of a trauma caused by lightning is a branched, dendritic, tree-like erythematosus pattern, dendritic, or that looks like a fern on the skin that appears in the first hour after the injury and fades quickly (similar to a reaction of hives and erythema). There can be cardiorespiratory arrest, in which the cardiopulmonary resuscitation is especially effective when it is started quickly, aggressively and must be maintained for quite some time).

The electricity that flows through the tissues generates heat. The resistance offered by the tissues varies depending on the tissue type (table 3). As it is the bone that accumulates the most, one can say that the damage due to electrical trauma is from the inside towards the outside (Iceberg effect). The muscle tissue develops oedema and necrosis, and compartmental syndromes may appear in the first 48 hours after the trauma.

+ GREATER RESISTANCE
BONE
FAT
TENDONS
SKIN
MUSCLE
VESSELS
NERVES
- LESSER RESISTANCE

The main clinical manifestations of electrical trauma are:

- **Cutaneous**: burns of varying degrees (dermal and subdermal). An attempt should be made to identify the entry burn (in the electric current) and the exit burn (of the electric current).
- **Muscular:** the behaviour of the electrical trauma in relation to the muscles is similar to a crush syndrome. It produces oedema and muscle necrosis that produces an enzymatic increase (CPK and myoglobin) and potassium. The monitoring of the increase of the CPK is useful in the diagnosis of muscle damage and in the control of the response to treatment. The increase of the myoglobin can result in kidney damage that must be controlled.
- **Vascular**: electrical trauma produces thrombosis of the vessels.
- **Cardiac**: cardiac monitoring should be performed for at least 24 hours. Low voltage: produces cardiac arrhythmias early. High voltage: produces sinus tachycardia and changes in the T wave.
- **Neurological**: the neurological clinical manifestations are highly variable and can be seen as acute or late peripheral neuropathy (29%), medullary damage (2-5%), loss of consciousness, headache, seizures…
- **Bone**: fractures occur in up to 10% of cases due to muscle tetanisation.
- **Other**: injuries can occur in the intraabdominal organs, abdominal perforation, pancreatic necrosis or liver, kidney damage, ocular alterations, etc.

Hydro-electrolytic replacement in the patient with electrical trauma does not follow the Parkland formula, but an IV pattern should be maintained with Lactate Ringer for diuresis 1ml/kg/h.
The topical treatment of electrical trauma burns is the same as that of any thermal trauma.

8.2. CHEMICAL BURNS

Most chemical burns are little extensive but deep. The intensity of a chemical burn will depend on:

- Concentration of the chemical agent.
- Quantity of product that causes the burn.
- Exposure time or contact with the skin.
- Tissue penetration.
- Action mechanism or toxicity of the chemical agent.

Chemical burns are classified according to the characteristics of the causative agent and according to the mechanism of the tissue injury. Unlike thermal burns, the tissue damage does not cease until the tissues or medical treatment neutralises the product, therefore, the estimate of the burn depth is difficult and varies according to the time elapsed since the exposure to the product.

The main types of chemical agents are:

- **Acids**: they are proton donor substances, releasing hydrogen ions and can lower the pH from 7 to 0. Acids with a pH less than 2 cause necrosis by clotting on contact with the skin. Burns by acids are more frequent and less severe than burns by bases.
- **Bases**: they are proton acceptor substances, the pH can vary from 7 to 14. Those with a pH greater than 11.5 produce serious damage by causing necrosis by liquefaction.
- **Organic solutions**: act by dissolving the lipid membrane of the cells and altering the cellular protein structure.
- **Inorganic solutions**: damage the skin by direct contact and the formation of salts. They also produce an exothermic reaction, which contributes to tissue damage.

The main action mechanisms of chemical substances are:

- **Oxidation**: protein denaturation is produced by inserting oxygen ions, sulphur or halogenated substances (chromic acid, bleaches, potassium) into the protein molecule.
- **Reduction**: the reduction of the amino links leads to protein denaturation (mercurial, hydrochloric acid and nitric derivatives).
- **Corrosion**: cause direct and massive protein denaturation (cement, sodium hydroxide).
- **Cellular or protoplasmic poisons**: produce formation of esters from fatty acids of cell membranes, or interfere with the cellular homeostasis mechanisms (oxalic acid and hydrofluoric).
- **Dehydrating**: substances that extract water from the affected tissues (sulphuric acid).
- **Blistering or that form blisters**: (Spanish flies, Nitrogen mustards, etc).

The initial management of a chemical burn is exactly the same as that of any thermal trauma with the following special considerations:

- Abundant irrigation with water or physiological saline solution (never immersion) in the place of the accident and which must be repeated on reaching the hospital centre. The irrigation period should be at least 30 minutes. Copious irrigation with water has been shown to reduce the severity of the burn and reduce the hospital stay.
- Special attention should be given to the identification of the causative agent of the burn and the exposure time to be able to address the treatment accurately.
- Avoid the use of neutralising agents, in the majority of cases the neutralising agents are difficult to obtain and have not shown to be better than continuous irrigation with water or physiological saline with the exception of a few cases. In addition, the use of neutralisers can aggravate the injury by producing heat generating chemical reactions with some chemical agents (lithium, sodium, magnesium and potassium).
- Avoid hypothermia due to the continuous irrigation with water or physiological saline. An attempt should be made to avoid this complication maintaining the temperature of the place of the accident between 28 and 31ºC if possible, and the temperature of irrigation as close as possible to the body temperature.
- The alteration of the pH is the largest systemic complication, so that arterial blood gases and electrolyte analysis must be carried out on a regular basis to ensure metabolic stability.

- ASSESSMENT BY OPHTHALMOLOGY in case of ocular burns. It is recommended that irrigation is begun with water as soon as possible and for a long time (30-60 minutes), since a minimum amount of chemical may produce a significant damage.
- If affectation of the respiratory tract is suspected it should be treated like an injury by inhalation - protect the airway, oxygen therapy and if necessary orotracheal intubation and mechanical ventilation with positive pressure at the end of the expiration.
- The principles of treatment of the wound-burn produced by chemical agents are the same as in any thermal injury. Dressings should be carried out with topical antimicrobials (silver sulphadiazine), initial debridement and cutaneous coverage in non-viable tissues.

The exposure to **hydrofluoric acid** generates an intense heat and important tissue damage. If this affects more than 5% of the BSA or more than 1% of BSA if its concentration is higher than 50% hospitalisation is required for electrocardiographic monitoring and to monitor the serum levels of calcium, because arrhythmias and hypocalcaemia may appear. Its treatment includes abundant washing/irrigation with water followed by the application of a calcium gluconate gel or subcutaneous injection of calcium gluconate at 10% (0,5 ml / cm^2) with the aim of relieving the pain. If there is no response to the medical treatment immediate surgical excision of the lesion must be carried out in the Burns Unit.

Exposure to **caustic soda** (sodium hydroxide), very common in cleaning product. Chemical burns are frequent due to oral ingestion of soda in the context of suicide attempts. In home environments burns are generally small in size, but in industrial environments there can be extensive burns. Caustic soda has the ability to penetrate deeply into the skin and tissues causing tissue destruction that is perpetuated in the time after the initial exposure. Systemic effects can occur due to the absorption of the chemical. Ocular affectation is particularly serious because of the rapid corneal penetration (it can cause scars, corneal opacification and perforation). **(Photo 13)**.

Photo 13. Burn due to caustic soda

The treatment consists in continuous irrigation with water or physiological saline (at least 2 hours with periods of rest of 4 hours). Water irrigation may not eliminate the chemical product from the deeper layers of the burn, in these cases, and if the status of the patient allows it, a tangential excision of the deep burns must be performed and covered with skin graft or temporary dressings. In the event of ingestion the person must be given a glass of milk or water (provided that the person does not present convulsions, difficult airway or decreased consciousness), and vomiting must NOT be provoked.

8.3. INJURIES DUE TO CONTRAST EXTRAVASATION OR CYTOSTATIC AGENTS

Injuries caused by the extravasation of an agent cannot be considered as burns as such, however, they can cause an acute skin failure similar to a burn, which is why we include them in this section. Their treatment will be similar to that of a burn, but with certain considerations depending on the type and quantity of extravasated agent, as well as the reaction of the patient's skin.

8.3.1. EPIDEMIOLOGY LESIONS DUE TO EXTRAVASATION

Although extravasation injuries, both of cytostatic agents as well as those of contrast, are infrequent (it is estimated that around 0.1 and 0.01 patients of every hundred patients in 15 years are referred to the Plastic Surgeon due to an extravasation, they must be taken into consideration because they can produce skin failure of similar characteristics to a burn.

The most important risk factors for the occurrence of extravasation of substances are:

- Numerous prior venepunctures.
- Fragile, small or weak veins. For example, in patients with lymphedema, history of lymphadenectomy, or amputation of an upper limb, because we would only have availability of access to veins of the other limb that is not affected.
- Poor collaboration of the patient at the time of the injection (voluntary or involuntary movements…)
- Local sensitive alterations of the patient or the mental state (prior paralysis or stroke, drowsiness, cognitive impairment), which prevent the patient to detect early alterations in the injection site.
- Extensive skin diseases (psoriasis, dermatitis…)
- Obesity.

8.3.2. ETIOPATHOGENESIS LESIONS DUE TO EXTRAVASATION

The agents that produce skin alterations due to extravasation are sorted simply into antineoplastic and non-antineoplastic:

- The antineoplastic or cytostatic agents are divided into irritant and blistering.
- Non-neoplastic agents are mainly contrast agents used in conventional radiology or interventionist studies.

The extravasation of a cytostatic agent or of a contrast agents can cause a secondary skin necrosis that is not considered a chemical burn as such, but that is a separate entity, due to the fact that the effect of cellular necrosis is not due to skin contact with this substance (as it would be in the case of chemical burns), but that is explained as secondary to the two mechanisms:

- Direct action of the substance, which is located in the subcutaneous cellular tissue or subdermis, in contact with the skin, inducing cytotoxicity and necrosis.
- Indirect action of the substance, which through the mass effect in the subcutaneous or muscular compartment generates suffering and skin ischemia as the volume of the deep planes is increased. In this case, skin necrosis would be secondary to prolonged skin ischemia and absence of surgical treatment of compartment syndrome associated with it.

Usually the two mechanisms interact to produce the skin failure.

8.3.3. CLINICAL PRACTICE OF LESIONS DUE TO EXTRAVASATION

The clinical manifestations depend on the type of chemical agent extravasated:

- **NON-NEOPLASTIC AGENTS**: the mechanism by which their action is exerted is cell toxicity. Two types of substances are generally differentiated:
  - **Irritants**: they generate a local inflammatory reaction (local oedema, erythema, heat and hypersensitivity) with phlebitis in the injection point or along the vein, itching, burning, and cutaneous tightness. There is no necrosis or peeling of the skin. The symptoms usually last for hours, and produce long-term sequelae.
  - **Blistering agents**: they generate tissue necrosis and scaling, sometimes resulting in loss of total skin thickness. The symptoms starts with local skin burning, followed by peeling skin and blistering at 2 or 3 days and necrosis could develop in a staggered manner, because it can appear in weeks or months. Long-term sequelae are more frequent than with the irritants. The most significant vesicant group is anthracyclines.

- **CONTRAST AGENTS**: the mechanism by which they usually exert their action is the alteration of osmolarity (hyperosmolar agents) and direct compression of the tissues, generating secondary ischemia.

  This local reaction produced in the skin and adjacent tissues by the extravasated agent may also cause the appearance of compartmental syndrome.

  The extravasations that take place at central venous catheter level, unlike those that occur in peripheral routes, in addition to the skin affectation, can present affectation of mediastinum and pleura.

8.3.4. EXPLORATION LESIONS DUE TO EXTRAVASATION

The clinical evaluation of the cases of contrast or cytostatic extravasation generally require a precise medical history (the same as in any type of burn), paying special attention to the type of agent extravasated and estimate of volume extravasated to guide the severity of the clinical situation. However, what determines the type of treatment is not the quantity of agent extravasated, but the clinical assessment.

Photo 14. Extravasation of contrast agent

The extravasation of substances takes generally place in the upper limb. The technical examination shall be focused on:

- Observation: Attention should be given to the emergence of signs of skin suffering, such as erythema, oedema, phlyctenae, blisters or necrosis.
- Touch: the existence of data for compartment syndrome must be assessed or of the risk of it being presented: warning data would be the emergence of distal coldness in the hands, distal paresthesia, local hard touch in the extravasation area or in the compartment.
- The confirmation of compartment syndrome is carried out through needle puncture and measuring the intracompartimental pressure. If it is greater than 25 mm Hg, this confirms compartmental syndrome.
- In clinical practice, it is usually not necessary to resort to this measure, since the symptoms of compartment syndrome is an indication of urgent surgical treatment regardless of the measurement of the pressure in the compartment.

8.3.5. PREVENTION OF LESIONS DUE TO EXTRAVASATION

There are a few basic guidelines which must be followed in order to avoid extravasations:

- The peripheral pathway must be channelled before the start of the infusion; the old route should preferably not be used for the infusion of cytostatic or contrast agents. By order of preference, we shall select forearm, back of hand, wrist and antecubital fossa.
- A good backflow of blood must be confirmed. Between 5 and 10 ml of saline must first be perfused to verify that the route is permeable.
- Areas with scars, sclerosis or thrombosis, or previously radiated areas should be avoided, as well as limbs with lymphedema or hypoperfusion.
- The cannula should be secured through the application of a plaster that holds the peripheral pathway.
- The infusion should be stopped and the patient reviewed if the patient has any symptoms, such as local pain or paraesthesia in the infusion area, or chest pain or shortness of breath in the case of central catheters.

8.3.6. TREATMENT OF LESIONS DUE TO EXTRAVASATION

Although there are no random clinical trials for the specific treatment of each extravasated agent, there are guides depending on the extravasated agents, guides that are available in the units where these types of agents are perfused.

There are also some general guidelines for management of extravasations:

- If there is clinical suspicion of extravasation of an agent, the infusion must be stopped immediately. It is not recommended that local pressure be applied or the route be washed.
- The catheter must not be immediately withdrawn, but is maintained to suck up the excess extravasated agent, and for the administration of the possible antidote.
- Keep the limb raised, to improve venous return and decrease the swelling and the risk of compartment syndrome.
- It is recommended that the patient mobilise the joints of the upper limb separately: open and close fingers by mobilising the proximal and distal interphalangeal joints, as well as the metacarpophalangeal joints, mobilising the wrist and also the elbow.
- Apply local cold, except in the case of the vinca alkaloids (vincristine) or the etoposide, in which it is recommended to apply heat.

- Currently there is still disagreement about the administration of specific antidotes. There are no randomised clinical trials in humans about the application of antidotes such as Dimethylsulphoxide, Hyaluronidase or Dexrazoxane, but studies are underway.
- The administration of non-steroidal anti-inflammatory drugs intravenously is recommended, to reduce the formation of oedema and local inflammation. Corticosteroids are not indicated, except in the case of extravasations of oxaliplatin.
- In extreme cases, with clinical suspicion of compartment syndrome due to increased intracompartimental or extracompartimental pressure with data of skin suffering, surgical treatment will be carried out consisting of decompressive fasciotomies, to avoid ischemia and muscle necrosis or of the soft tissues surrounding it. The clinical suspicion and the treatment is the same in cases of compartment syndrome produced by burns.

Photo 15. Extravasation of contrast agent in the back of the hand of a new-born. Compartment syndrome symptoms which required surgical treatment

- In the event of there being areas with skin failure, conservative treatment is initially performed with local dressings, using the same criteria as in the treatment of an acute skin failure produced by a burn.
- In the event that the areas of skin failure do not heal with conservative treatment they may require surgical treatment, consisting in the carrying out delayed debridement and grafting.

09 GENERAL PREVENTION GUIDELINES. EVIDENCE AND RECOMMENDATIONS

Most literature on this subject is essentially on prevention in children, as they are extremely sensitive to thermal injury.[40] It is therefore important to teach the general population to identify the risk factors and suggest rules to follow to avoid them, through educational campaigns aimed at avoiding the risk factors that produce burns: hot solids and liquid substances, electricity, flames and corrosive substances.

The main general rules of prevention refer to:

- Not smoking inside the home and much less so in bed.
- Not overloading power sockets.
- Not using fireworks or similar.
- Keeping matches, lighters, chemicals, and lit candles away from children.
- Fitting plug protectors.
- Smoke alarms at home are recommended.
- Place the TV and music equipment against the wall.
- Place screens in front of chimneys.

In the bathroom:

- Water thermostats in bathrooms allow you to adjust the water temperature. Temperatures of 54º may scald a child in two or three seconds.
- When filling the bath start with cold water and end with cold water.
- Introduce the elbow (adult), to test the temperature.
- Disconnect all electrical appliances that are not being used.

In the Kitchen:

- Do not allow children to use walkers in the kitchen.
- Do not have hot drinks while you have a child on your lap.[40]
- Do not hold a child in your arms while cooking.
- Do not heat baby's bottles in the microwave.[40]
- Keep the handles of pots and pans away from the reach of children.
- Meals and hot drinks must be out of the reach of children.[40]

Adults:

- Adult burns are associated to the dangers inherent to modern society. People have the same risks, but increased by the loss of reflexes associated with age.
- Prevention must be associated with the strengthening of the safety standards.
- The home is where the majority of the accidents occur, so it is important to review the installation of gas, electricity, electrical appliances and storage of flammable and corrosive liquids.[40]
- For adults after the home, work is the next scenario where such accidents happen. Occupational safety standards must be followed and strengthened.
- Finally, accidents also occur during leisure: motorcycle exhausts, barbecues, sunburn, etc. Here some of the rules previously seen and above all a lot of common sense must prevail.

RECOMMENDATIONS[40, 41, 42]

Avoid the unsupervised presence of children in kitchens and bathrooms.	Very low.
Store caustic substances in safe places, away from the reach of children.	Very low.
Be careful with the handling of hot liquids in the presence of children.	Very low.
Increase the dissemination of a culture of prevention in burns.	Very low.
Children under five years old have an increased risk of burns.	Very low.
Mortality is increased in children under three years of age.	Very low.
The most serious damage is by immersion in hot liquids and by fire.	Very low.
The kitchen and bathroom are the sites where burns most often happen.	Very low.
An increase of burns has been observed during the preparation of food in the microwave.	Very low.

10 SUMMARY OF EVIDENCE RECOMMENDATIONS

EVIDENCE [E] / RECOMMENDATION [R] / GOOD PRACTICE [GP]		LEVEL / GRADE
[R]	Do not apply very cold or frozen water (<15ºC).	**LOW** (GPC SAS, 2011).[5]
[R]	Moisturise the skin to restore moisture.	**LOW** (GPC SAS, 2011).[5]
[R]	Use sunscreen protection products (FPS>15) in epithelialised areas.	**MODERATE** (GPC SAS, 2011).[5]
[GP]	Protect from the sun (during 15-30 days).	**LOW** (GPC SAS, 2011).[5]
[R]	Rinse with potable water or saline solution.	**MODERATE** (GPC SAS, 2011)[5].
[R]	Dry the lesion without rubbing the injured area.	**LOW** (GPC SAS, 2011).[5]
[R]	If an antiseptic is necessary, use chlorhexidine digluconate.	**MODERATE** (GPC SAS, 2011).[5]
[R]	Debride blisters or phlyctenae.	**LOW** (GPC SAS, 2011).[5]
[R]	In second-degree burns without risk of infection it is not necessary to apply topical antimicrobials.	**MODERATE** (GPC SAS, 2011).[5]
[R]	There is not enough evidence on the effectiveness of a healing dressing in humid environment over another.	**HIGH** (GPC SAS, 2011).[5]
[R]	Use dressings with low and adaptable adherence.	**MODERATE** (GPC SAS, 2011).[5]
[R]	Hydrocolloid dressings are suitable for the management of exudate in superficial burns.	**MODERATE** (GPC SAS, 2011).[5]
[R]	Hydrocellular dressings have higher absorption capacity that hydrocolloid ones.	**LOW** (GPC SAS, 2011).[5]

[R]	Dressings with silicone protect the perilesional and epithelialised skin.	**MODERATE** (GPC SAS, 2011).[5]
[R]	The topical antibiotic of first choice in second- and third-degree burns, is silver sulphadiazine.	**HIGH** (GPC SAS, 2011).[5]
[R]	In third-degree burns sulphadiazine shall be applied with cerium nitrate.	**MODERATE** (GPC SAS, 2011).[5]
[R]	Silver dressings can help reduce dressingsand average hospital stay.	**MODERATE** (GPC SAS, 2011).[5]
[R]	Silver dressings, compared with sulphadiazine, reduce pain during dressings.	**MODERATE** (GPC SAS, 2011).[5]
[R]	Do not use systemic antibiotics preventively in minor burns.	**VERY LOW** (GPC SAS, 2011).[5]
[R]	Silver dressings can help reduce dressings and average hospital stay.	**MODERATE** (GPC SAS, 2011).[5]
[R]	Clean eyes several times a day.	**VERY LOW** (GPC SAS, 2011)[5].
[R]	Use chlorhexidine 0.12% as a mouth antiseptic.	**MODERATE** (GPC SAS, 2011).[5]
[R]	Use barrier products of the mucosa and protective agents of the mucosa.[34]	**VERY LOW** (GPC SAS, 2011).[5]
[R]	Evaluate the state of nutrition individually and continuously until healed.	**VERY LOW** (GPC SAS, 2011).[5]
[GP]	It is recommended that the caloric intake does not exceed 200% of the estimated energy expenditure.	**VERY LOW** (NUT HOPS, 2005).[36]
[R]	Burned patients will receive a high protein intake.	**HIGH**(GPC SAS, 2011).[5]
[GP]	The preferential use of enteral nutrition is recommended.	**VERY LOW** (GPC SAS, 2011).[5]
[R]	Enteral nutrition should be administered early.	**MODERATE** (GPC SAS, 2011).[5]
[GP]	A glucose intake is recommended.	**VERY LOW** (NUT HOPS, 2005).[36] (JPEN, 2002).[37]

[R]	The dressing of the fingers shall be carried out one by one, to avoid the adhesion between them	**LOW** (GPC SAS, 2011).[5]
[GP]	Elastic or cohesive bandages will be used to allow the expansion of physiological oedema. The ideal is elastic tubular mesh 3,5	**VERY LOW** (GPC SAS, 2011).[5]
[E]	Avoid the unsupervised presence of children in kitchens and bathrooms	**VERY LOW** (COCHRANE, 2004).[40]
[E]	Store caustic substances in safe places, away from the reach of children	**VERY LOW** (COCHRANE, 2004).[40]
[E]	Be careful with the handling of hot liquids in the presence of children	**VERY LOW** (COCHRANE, 2004).[40]
[GP]	Increase the dissemination of a culture of prevention in burns	**VERY LOW** (COCHRANE, 2004).[40]
[GP]	Mortality is increased in children under three years of age	**VERY LOW** (COCHRANE, 2004).[40]
[GP]	The most serious damage is by immersion in hot liquids and by fire	**VERY LOW** (COCHRANE, 2004).[40]
[GP]	The kitchen and bathroom are the sites where burns most often happen	**VERY LOW** (GPC SAS, 2011).[5]

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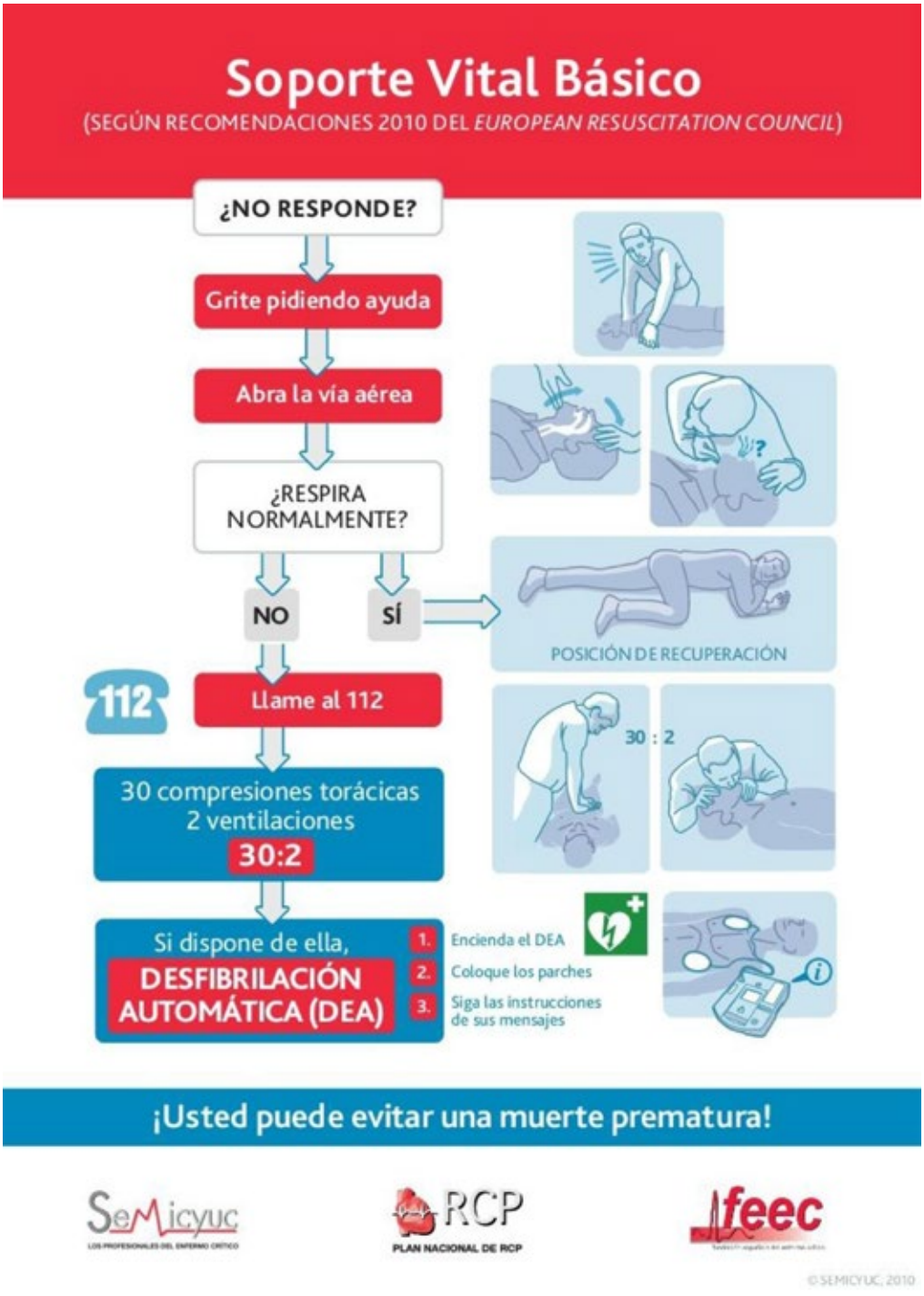
12 ANNEX

ANNEX 1
BASIC LIFE SUPPORT ALGORITHM OF ADULTS



Source: Adaptation of the Manual of advanced life support in pre-hospital emergencies. Fundación Pública Urxencias Sanitarias de Galicia- 061

Guides 2010 for cardiopulmonary resuscitation of the European Resuscitation Council.

12 ANNEX TRANSLATION

ANNEX 1
BASIC LIFE SUPPORT ALGORITHM OF ADULTS

Basic Life Support
According to recommendations of the European 2010 Resuscitation Council

Not responding?

Open airway

Ask for help

Breathes normally?

NO

Call 112

30 chest compressions
2 ventilations
30:2

If available DESFIBRILLATION AUTOMATIC (DEA)

1. Turn on DEA
2. Place the defibrillation patches
3. Follow the instructions of its messages

YES

RECOVERY POSITION

30:2

You can avoid a premature death

INDEX OF PHOTOS AND IMAGES

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XUNTA DE GALICIA

CONSELLERÍA DE SANIDADE