



European Burns Association

European Practice Guidelines
for Burn Care

Minimum level of Burn Care
Provision in Europe

*With the contribution of all the
Executive and PAM Committees members*

*2011 - **First Edition** - The Hague/The Netherlands*

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European Burns Association

The European Burns Association is a non-profit making organisation for the benefit of the public, to promote burn prevention, to study the prevention of burn injury and all other aspects of burn treatment.

European Burns Association Community

Official EBA website – www.euroburn.org

Official EBA Prevention Mail - EBAPrevention@gmail.com



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Notice

Medical knowledge is constantly changing. Standard safety precautions must be followed, but as new research and clinical experience broaden our knowledge, changes in treatment and drug therapy may become necessary or appropriate. Readers are advised to check the most current product information provided by the manufacturer or each drug to be administered to verify the recommended dose, the method and duration of administration, and contraindications. It is the responsibility of the practitioner, relying on experience and knowledge of the patient, to determine dosages and the best treatment for each individual patient. Neither the Publisher nor the Author assume any liability for any injury and/or damage to persons or property arising from this publication.

FOREWORD

Clinical Practice Guidelines (CPG's) are currently a regular part of a clinician's armamentarium in virtually all branches of medicine. These guidelines are constantly upgraded and expanded through the work of physicians around the world. CPG's in burn medicine also play an important role in successful burn treatment. European Burns Association (EBA) and namely its Executive Committee (EC) recognize the value of CPG, but have identified duplicity and varying levels of quality in the different national and other Practical Guidelines for Burn Care.

Europe is a continent moving towards the unification of virtually all aspects of life, including medicine and burn care. Open borders allow European citizens to move freely between countries. In the same respect, health care personnel are seeking employment in counties other than where they have received their training. This brings into question the quality of education received in the home country in relation to the established level in a different land. In the case of injury or illness in a foreign country; European citizens may find themselves in a medical facility, which does not meet the standards of their home country. This is a pressing issue among patients, insurance companies and national health care authorities.

This is the driving force behind the development of European Guidelines for Burn Care Provision, which will recommend, among other things, the Minimum European Level of Burn Care Provision. Guidelines for Minimum European Level of Burn Care Provision could become an important tool in improving burn care in Europe.

A lot of work has been done by EBA to create and have these guidelines approved, especially after the appearance and success of the American Burn Practice Guidelines in the year 2001. For this purpose EBA EC has established the special Guidelines Committee, which together, with the Executive Committee is dealing with this extensive and difficult task.

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Both these bodies would like to express their gratitude to all, contributing to the process of creating the European Practice Guidelines for Burn Care and invite all being involved in Burn Care and/or being interested in this topic to co-operation and expression of their opinions.

Minimum European Level of Provision (Delivery) of Burn Care could be an important tool of improvement of Burn Care in Europe.

Also and finally, I would like to express my special thanks to the whole Professions Allied to Medicine (PAM) working group for the hard and efficient work on this document.

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BC	Burn Centre
BICU	Burn Intensive Care Unit
CES-D	Centre for Epidemiologic Study Depression Scale
CPG	Clinical Practice Guideline
EBA	European Burns Association
EBM	Evidence Based Medicine
EBP	Evidence Best Practice
EC	Executive Committee
EEA	European Economic Area
EFTA	European Free Trade Association
EU	European Union
OT	Occupational Therapist
PAM	Professions Allied to Medicine
PT	Physiotherapist
TBSA	Total Body Surface Area
WHO	World Health Organization

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FIRST PART

MINIMUM LEVEL OF BURN CARE PROVISION IN EUROPE

1. INTRODUCTION

Clinical Practice Guidelines (CPG's) for various medical fields first appeared in publications in the early 1990's. CPG's offer structured and highly qualified reviews of relevant literature, giving physicians the best available information gained from concrete clinical studies to improve treatment (Evidence Based Medicine - EBM).

This concept has proven to be very useful and currently thousands of CPG's exist for a wide range of medical branches. CPG's have contributed significantly to the upgrading of many medical strategies and work is being done to further improve these guidelines.

At present, "Guidelines or Recommendations" work with 3 categories of evidence and suggestions: Standards, Guidelines and Options.

1.1. STANDARDS

They are generally accepted principles of treatment based on a very high degree of clinical certainty supported by Class I evidence (based on prospective, randomised controlled clinical studies). Standards are rigorously applied rules. Some European countries have their own approved standards for some steps in clinical burn treatment.

1.2. GUIDELINES

They are strategies of treatment based on moderate clinical certainty supported by Class II evidence (retrospective studies with relatively clear results). Guidelines should be followed and only broken if medically justified. This level of clinical certainty (Class II evidence) is much more frequent and accessible.

Unfortunately, the word Guidelines is used in a more global sense for all 3 kinds of recommendations and also in a more specific sense for this middle category. This is unfortunately misleading, but routinely used.

1.3. OPTIONS

They are possible ways of treatment based on personal clinical observation and/or Class III evidence (clinical series, case reports, expert opinions, etc.).

Options should be put through future clinical studies.

1.4. GENERAL OUTLINING OF THE EUROPEAN GUIDELINES FOR PROVISIONAL BURN CARE

When speaking about the Practice Guidelines for Provisional Burn Care, the following questions should be answered:

- What is burn injury and burn care in general?
- Where should burn care be provided?
- Who should be the subject providing burn care?
- Who should be the object of burn care?
- How should burn care be provided?
- Which European countries are involved?

These questions will be discussed in the following chapters. There is more interest in the category Organization of Burn Care delivery (where it is done, who is the object and who is the subject of the burn care) than the others. Therefore, definition of a Burn Centre and the Transferral Criteria to the Burn Centre are explained in detail.

There is an explanation for this fact. Whereas evidence based basal steps in burn treatment are the same in all over the world, the organisation of delivery differs regionally.

Consequently, EBA EC will propose its own recommendations. They should be used as guidelines for classification of medical facility as a burn Centre, thus fulfilling the recommendations of the European Burns Association.

2. BURN INJURY AND BURN CARE IN GENERAL

A Burn is a complex trauma needing multidisciplinary and continuous therapy. Burns occurs through intensive heat contact to the body, which destroys and/or damages human skin (thermal burns). In addition to thermal burns, there are electric, chemical, radiation and inhalation burns. Frostbite also comes under this category.

Burn Care is the complex and continuous care for burn patients:

- The main goal of this care is to ensure optimum resuscitation in the emergency period and then to reach re-epithelialization of injured or destroyed skin either by support of spontaneous healing or by surgical necrectomy and grafting with split thickness skin graft. Subsequent treatment is to ensure the optimum post burn quality of life.
- Burn care includes thermal as well as electric and chemical burns. Inhalation and radiation injury and frostbite also comes under this category.
- Developments over the last several decades have clearly shown that burn care treatment offered in specialised burn centres brings better results than in non-specialized centres.
- Through the gathering of experience and critical evaluation of relevant literature, recommendations have been made to facilitate the optimum delivery of burn care including specific diagnostic and therapeutic procedures.

Burn treatment as part of burn care aims to provide:

- First aid.
- Pre-hospital care.
- Transportation to an appropriate medical facility.
- Management of the emergency period (resuscitation).
- Renewal of damaged and destroyed skin in acute periods.
- Prevention and treatment of all complications.
- Main surgical reconstruction.
- Somatic and psychosocial rehabilitation.

3. BURN CARE PROVISION RECOMMENDATIONS FOR EUROPEAN MINIMUM LEVEL OF PROVISIONAL BURN CARE

The most important aspects of Burn Care Provision can be concentrated into two definitions:

- The Burn Centre.
- Transfer criteria to the Burn Centre.

These two topics are elaborated in details.

3.1. THE BURN CENTRE

The BC is an organized medical system for the total (complex and continuous) care of the burn patient. It is the highest organized unit among the Burn Care facilities.

The BC:

- Has appropriate spaces and spatial arrangement.
- Is situated inside a hospital.
- Is properly equipped for all aspects of the treatment of burn patients.
- Treats adults and/or children with all kinds and extents of burns.
- Includes a medical staff and an administrative staff dedicated to the care of the burn patient.
- The Burn Centre is the highest form of Burn Care Facility.
- Sustains a very high level of expertise in the treatment of the burn patient.
- Conducts a certain minimal number of acute procedures and consequent reconstructive surgical procedures per year.

3.1.1. THE BC SPACE AND SPACIAL ARRANGEMENT

- Should have access to an operating room with at least 42 m², air conditioning, preferably laminar airflow and wide range temperature settings for acute surgical burn treatment.
- This operating room is equipped with all the needs for burn surgery and a respiratory assistance service on a 24-hour basis.
- A second theatre should be devoted to secondary burn reconstruction.
- Should have at least 5 acute beds specially equipped and designed for the care of a major burn patient, i.e. high room temperature, climate control, total isolation facilities, adequate patient surveillance, intensive care monitoring facilities, etc.
- Have an established current germ surveillance program.
- Include enough regular beds in the adult and/or children's wards to meet current needs.
- Have enough specialised and equipped spaces for rehabilitation and occupational therapy.

3.1.2. THE BC SITUATED INSIDE A HOSPITAL

- Should maintain or at least have access to a skin bank.
- Must have easy access and cooperate with other departments, especially with Radiology, Microbiology, Clinical Biochemistry, Clinical Haematology, Immunology, Surgery, Neurosurgery, Internal Medicine, Neurology, ENT, Ophtalmology, Gynaecology, Urology, Psychiatry etc.

For these reasons, a Burn Centre should be situated inside the largest hospitals in each country.

3.1.3. THE BC IS PROPERLY EQUIPPED FOR ALL ASPECTS OF THE TREATMENT OF BURN PATIENTS

The BC has equipment of sufficient quality and quantity for specialized burn care. This includes instruments currently found in surgical operating theatres, Intensive Care Units and Standard Care Wards in addition to specialised knives (Humby, Watson...) and dermatomes (either electric or air driven) mesh and or meek dermatomes, etc.

3.1.4. THE BC INCLUDES A MEDICAL STAFF AND AN ADMINISTRATIVE STAFF DEDICATED TO THE CARE OF THE BURN PATIENT

The main features of the Burn Centre Personnel (Staff) are as follows:

The Burn Centre Director (Chief of staff, leading burn specialist)

- A medical specialist dedicated to and experienced in burn treatment, familiar with all aspects of complex and continuous burn care (with at least 10 years of clinical practice), taking responsibility for all activities at the Burn Centre.
- Formal education typically is: plastic surgeon, general surgeon, anaesthetist or intensivist. Surgical background is preferred, as the causal treatment of severe burns is done with surgery, but an intensivist with some surgical training and education is also acceptable.
- Typically, a post-graduate education lasting a minimum of 5 years.
2 years basal education in surgery (22 months in a surgical department, 2 months in an internal department.
3 subsequent years in a burn centre (including 1 year in a department of plastic surgery, 2 months in a department of anaesthesiology and intensive care for children/adults).
- After certification, another 5 years working in a burn centre is recommended.

Staff Physicians

- Staff physicians must have a high level of expertise in burn treatment. This can be attained through two years of instruction in a burn centre, which follows basic practices in surgical and internal skills. In centres treating children, paediatricians (incl. paediatric surgeon) must also be present. A burn centre must have at least one full time burn care surgeon (specialist) and one anaesthetist available in the centre on a 24-hour basis.
- The minimal number of staff physicians is one per 2 intensive beds.
- Acute surgical burn wound treatment is provided by the team recruited from the burn centre staff. This team must always consist of a burn surgeon plus 2 to 3 paramedics and an anaesthetist with his/her nurse.
- During surgery, at least one fully accredited burn specialist must be present in ICU.

Staff nurses

- Should be led by a registered nurse with years of experience in burn care in a burn centre, also possessing managerial expertise.
- Patients should have 24 hours access to a registered, highly skilled nurse experienced in the care of burn patients.
- The centre should be equipped with a sufficient amount of nurses to meet modern standards of care of burn patients. At least one nurse per patient on a BICU bed.
- Nurses should be able to handle all types and degrees of severity in burn and critically ill patient cases, different types of cutaneous wounds and ulcers and all aspects of primary rehabilitation.

Rehabilitation Personnel

- Burn centres should have permanently assigned physical and occupational therapists in the burn team.
- Rehabilitation personnel should have at least one year of experience in a burn centre.
- Rehabilitation personnel should deal with both in and out patients.

Psychosocial Work

- Burn Centres should have a psychologist and a social worker available on a daily basis.

Nutritional Services

- A burn centre should have dietician service available for consultation on a daily basis.

Other Staff Members

- Specialists cooperating closely with the burn team but not necessarily being on staff: general orthopaedic and cardiothoracic surgeons, neurosurgeons and neurologists, internists, ENT specialists, ophthalmologists, urologists, gynaecologists, psychiatrists, radiologists, biochemists, haematologists, microbiologists, immunologists and epidemiologists.

Having a well-educated and trained burn centre staff, along with appropriate space arrangement and medical equipment, is the key factor in improving burn care and its outcome.

Because of extreme importance of PAM (Professionals Allied to Medicine) for the complex burns treatment, their Clinical Guidelines are included as the separated part of this document.

3.1.5. THE BURN CENTRE IS THE HIGHEST FORM OF BURN CARE FACILITY

Lower organisation units other than a BC are:

- Burn Unit.
- Burn Facility.

These facilities provide only some aspects of Burn Care and are present in virtually all European countries. They are typically affiliated to surgical or paediatric departments and a unified European definition is currently not possible.

Severe burn patients, as defined in the next chapter, should not be referred to Burns Units and/or Burns Facilities for definitive treatment.

3.1.6. THE BURN CENTRE SUSTAINS A VERY HIGH LEVEL OF EXPERTISE IN THE TREATMENT OF BURN PATIENTS

To ensure the current high level of training and expertise in the treatment of all aspects of burns, a BC should adhere to the following items:

- Provide complex and continuous burn care.
- Be involved in teaching and research activities in addition to diagnostic and therapeutic activities.

3.1.7. CONDUCTS A CERTAIN MINIMAL NUMBER OF ACUTE PROCEDURES AND FOLLOW UP RECONSTRUCTIVE SURGICAL PROCEDURES PER YEAR

- A BC should admit at least 75 acute burn patients annually, averaged over a three-year period.
- A BC should always have at least 3 acute patients admitted in the centre, averaged over a three-year period.
- A BC must have in place its own system of quality control.
- A BC should perform at least 50 follow-up reconstructive surgical procedures annually.
- In Europe, one burn centre is advisable for every 3 -10 million inhabitants.
- BC treats adults and/or children with all kinds and extents of burns.

3.2. TRANSFERRAL CRITERIA TO A BURN CENTRE

It is very important to identify the patients who should be referred to a burn centre.

Patients with superficial dermal burns on more than:

- 5% of TBSA in children under 2 years of age.
- 10% of TBSA in children 3-10 years of age.
- 15% of TBSA in children 10-15 years of age.
- 20% of TBSA in adults of age.
- 10% of TBSA in seniors over 65 years of age.

In addition:

- Patients requiring burn shock resuscitation.
- Patients with burns on the face, hands, genitalia or major joints.
- Deep partial thickness burns and full thickness burns in any age group and any extent.
- Circumferential burns in any age group.
- Burns of any size with concomitant trauma or diseases, which might complicate treatment, prolong recovery or affect mortality.
- Burns with a suspicion of inhalation injury.
- Any type of burns if there is doubt about the treatment.
- Burn patients who require special social, emotional or long-term rehabilitation support.
- Major electrical burns.
- Major chemical burns.
- Diseases associated to burns such as toxic epidermal necrolysis, necrotising fasciitis, staphylococcal scalded child syndrome etc., if the involved skin area is 10% for children and elderly and 15% for adults or if there is any doubt about the treatment.

4. COUNTRIES CURRENTLY CONSIDERING PARTICIPATION IN THE CLARIFICATION OF EUROPEAN GUIDELINES FOR BURN CARE

The following European Countries and their population of over 500 million inhabitants are considering involvement into the clarification of European Guidelines for Burn Care:

Austria	Belgium	Bosnia and Herzegovina
Bulgaria	Croatia	Czech Republic
Estonia	Finland	France
Germany	Greece	Hungary
Iceland	Italy	Ireland
Latvia	Lithuania	Luxemburg
Norway	Poland	Portugal
Romania	Serbia	Slovakia
Slovenia	Spain	Sweden
Switzerland	The Netherlands	United Kingdom

These countries, with the exception of Switzerland, are either members of EU, EEA or EFTA, or will soon be joining one of these groups. In any case, these countries are already cooperating in the exchange of burn information.



The situation at present is unclear in several countries, which geographically are situated in Europe, but their level of cooperation, data exchange and/or other factors do not allow their involvement in the System of European Guidelines for Burn Care. These countries are Albania, Belarus, Moldova and Ukraine.

5. CONCLUSION

Presented statements do not, of course, have the form of standards and/or guidelines as mentioned at the beginning of this document. They must be “translated” or “converted” into the form of true standards and/or guidelines.

Nevertheless, this process is quite sophisticated, expensive and time consuming. That is why this article may be interesting for those involved in burn care in Europe.

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SECOND PART

BEST PRACTICE GUIDELINES FOR PROFESSIONS ALLIED TO MEDICINE

The Professions Allied to Medicine Committee of the Europeans Burns Association devised this part.

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1. INTRODUCTION

Best practice in burn care is achieved through a multi-disciplinary or multi-professional team which meets on a regular basis to assess patients' needs, set objectives and plan treatment interventions, within a bio-psychosocial model of care.

Burn care should be co-ordinated with the aims of providing optimal quality of care and achieving best quality of life for burn injured patients.

1.1. EVOLUTION

In 2002, a "State of the Art Symposium" was held in Copenhagen to commence working on producing "General Guidelines for Burn Care". The Professions Allied to Medicine (PAM) Committee acknowledged the need for the development of "Evidence Based Guidelines" for PAM, but we were aware of the enormity of undertaking such a task.

A decision was made to produce basic guidelines/recommendations for practice, to be used as working documents, and based on "Evidence of Best Practice". The Committee looked at various sources of guidance for developing guidelines:

- British Burn Care Standards.
- Practice Guidelines for Burn Care - American Burns Association.
- Principles and Management Guidelines for O.T. / P.T. - Australia and New Zealand Burns Association.
- Guidance on Developing Clinical Guidelines for O.T. / P.T. Professional bodies.

To date, the Committee has produced a number of guidelines/recommendations. It is anticipated that the Committee will continue to work on producing further guidelines to complement those included in this manual.

1.2. OBJECTIVES

- To provide a tool to assist with clinical decision-making.
- To provide a practical guide regarding the relevant clinical intervention techniques required for effective patient management.
- To make recommendations based on research evidence.
- To promote a consistent approach to best practice for PAM's within Europe working with people who have sustained burn injuries.

1.3. DISSEMINATION AND IMPLEMENTATION

- Presentation of guidelines to PAM professionals at EBA Congress for discussion and feedback.
- Posting of guidelines on PAM section of EBA website.
- Recommendations for trailing of guidelines.

2. ORGANIZATION

PAM stands for Professionals Allied to Medicine, which encompasses several different professions such as nurses, physiotherapists, clinical psychologists, educational and play therapists, speech therapist, dieticians, social workers, occupational therapists, ergotherapists, and others. Close liaison with other members of the team is essential as roles may overlap and vary from centre to centre, and from culture to culture.

Each burn unit will have PAM's assigned to the burn team. Members of the burn team will be experienced in burn treatment. Each member of the team must work in accordance with the guidelines defined in cooperation with the medical direction.

As the ideal burn unit is inserted in a general hospital, some of the PAM professional may be affiliated to the burn unit on a consultant basis. Best practice in burn care is achieved through a multidisciplinary-multi professional team which meets on regular basis to assess patient's needs, set objectives and plan treatment interventions within a biopsychosocial model of care.

Burn care should be co-ordinated with the aims of providing optimal quality of care and achieving best quality of life for burn injured patients.

The staffing has to be in accordance with the local legislation. However to fulfill the high level of needs for best patient care, additional resources would have to be set up. A shortage is identified as a source of adverse patient outcome. Some instruments for staffing evaluation are developed and sensitive to the specificities of a burn unit. To maintain a high quality of care a continuous training of all these professionals is mandatory on a regular basis as burn care covers a wide range of activities and situations. Multidisciplinary meetings are recommended on a weekly basis in order to review patients' biopsychosocial status, set goals and coordinate treatment and care actions. Attention should be paid to discharge modalities aiming at continuing of care despite transfer to step down unit or home. A care coordinator may facilitate following the patient during his care course, making connection within all the partners even when patient is at home. Specific reintegration programs should be utilized in this process. Each profession will develop contact with external caregivers to make sure that the patient receives the right treatment when at home. If necessary, PAM consultations could be set up.

2.1. NURSING

In the burn unit staffed with a sufficient amount of nurses to meet modern standards of care the burned patient will have access to a highly experienced nurse, all-around 24-hours.

This specialized nursing staff will be able to handle all types and degrees of severity of burned patients, critical ill patients, different types of cutaneous wounds and ulcers and rehabilitation. These specific competencies will be regularly trained and updated.

Pediatric burn care requires the availability of pediatric nurses.

The nurses screen the patient's needs on a holistic approach and if necessary refers to other specialists. Specialized nursing plans based on a defined philosophy (e.g. Virginia Henderson) will be developed and nursing procedures will be written and regularly reviewed.

2.2. PHYSIOTHERAPISTS

The main aim of physiotherapy in burns is the most possible mobility function, independence and performance after the injury. To achieve this, physiotherapy must be begun in the very early - acute - phase of burn care (ICU), and must focus on the support of

the cardiorespiratory system, oedema reduction, decubitus prophylaxis, prevention of burn scar contractures. Later, or rather parallel it comes to scar prevention/scar management, preserving and/or increasing the range of motion and muscle strength, increasing of tissue elasticity. Interventions: respiratory physiotherapy, positioning, moving through full range daily, splinting, soft tissue mobilization, isometric exercises, assisted active and active exercises, stretching, gradual mobilization, balance and coordination training. Psychological support, strength and endurance training, is needed for an effective physiotherapy, so as regular consultations. In children, family/parents instruction and education and their most possible involvement in the PE of the burned child is especially needed, beside regular consulting, so to ensure the continual PE of the child, even after discharge.

2.3. CLINICAL PSYCHOLOGISTS

The psychosocial dimension of the burn patient is a complex and fundamental component of the recovery and adjustment process which needs to be addressed as part of the standard clinical care for patients during hospitalization and after discharge. The role of the clinical psychologist is to provide individualized psychosocial care fitted to patients' and family needs within the multidisciplinary health care team goals; psychological assessment and psychotherapeutic interventions aimed at preventing and/or reducing negative emotional reactions, promoting compliance with care and psychosocial adjustment and well-being; assist health care team in managing patients and families.

2.4. DIETICIANS

The dietician will regularly visit the patients to evaluate the nutritional needs (using different formulas), to set the menus and to stimulate the anamnesis by the nurses, evaluating the accordance between real intakes and needs. There should be an individualized adjustment to the patient's clinical situation. The dietician will have contact with the MD for suggestions (TPN, trace elements...).

2.5. SOCIAL WORKERS

The main areas of responsibility of a social worker involved in the burn team are (1) ongoing monitoring of patient and family social needs; (2) assessing, supporting and developing the coping skills of the burn patient and family (3) facilitating communication

between staff and patient and family; (4) co-ordinating/encouraging commitment of resources (family, friends, outside supporting agencies/organizations); (5) networking of support systems for patient; (6) financial aspects and issues of employment, relationships.

2.6. OCCUPATIONAL THERAPISTS/ERGOTHERAPISTS

The main aim of the Occupational Therapist in burns is to maximise function - both physical and psychological, maximise independence, and facilitate return as much as possible to previous life roles at home, work and leisure.

The Occupational Therapist is involved in the assessment and practice of personal and domestic activities of daily living, and may include the provision of specialised aids and equipment to increase independence. Home assessment may be required to assess the patient's ability to return home and to arrange adaptations to the home / support services if required.

The Occupational Therapist may be involved in the provision of splints (orthoses) both in the early stages and post surgery, to assist in maintaining anti-contracture positions and prevent deformity / contractures.

2.7. SPEECH THERAPIST

A speech therapist involved in a burn team could help to prevent, assess and treat communication and swallowing disorders arising from burn and inhalation injuries, such as expressive and receptive language disorders, articulation disorders, fluency and voice disorders, problems of swallowing and feeding. He/she also can assist in facial contracture prevention and treatment and the patient's transition from parenteral to oral nutrition. Education, consultation and instruction of the patient and family is also offered.

2.8. PEDIATRIC CARE

For burn units accepting children there should be available additional resources, namely specialized professionals to deal with pediatric care. Care should be performed in close collaboration with parents/caregivers. Before discharge, education of these on care to be provided is recommended.

Education and information of parents/caregivers is of utmost importance.

2.9. EDUCATIONAL THERAPIST

Education of children in burn units/centres needs to be facilitated by the hospital in order to preserve normality, positive activities, emotional adjustment, developmental needs, particularly during long hospital stays.

2.10. OTHERS

In the future other therapists giving answers to new problems will be included in the team.

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4. GUIDELINES

4.1. NURSING GUIDELINES

4.1.1. NUTRITION

Recommendations

It is recommended that the nurses have an understanding of the rationale for patients' nutrition and collaborate with the burn team to ensure the patient has correct feeding. She (He) will cooperate with the MD to define / evaluate the amount of needs.

The final aim is sufficient nutrition for wound healing, considering the limits of the daily care (fasting, pain, sleep)

Regular evaluation is mandatory.

Considerations

The nurse should:

- Understand the principles underlying nutrition.
- Find the best way to feed the patient, even in combination with other alternatives (IV - GS - PO).
- Plan the delivery.
- Plan evaluation by some means (co-operation).
- Keep informed of the latest developments regarding nutrition.

Audit tools

- Scales.
- Daily (regular) weighing of the patient.
- Blood samplings (PS-Albumin).

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4.1.2. PAIN MANAGEMENT

Recommendations

- Burn pain should be managed by using a guideline-based approach.
- All burn centres should have a multi-disciplinary approach to the treatment of burn pain.
- Preferably, patients have an individualized pain management plan based on their individualized pain scores.
- Pain should be sub-scaled in: acute pain, procedural pain, and breakthrough pain.
- Pain should be measured with reliable assessment scales validated for the different age groups who attend a burn centre.
- Pain assessment, including (pain-related) anxiety, add to complete documentation of the patient's pain which in turn contributes to adequate pain management.
- Health care professionals should understand the principles of analgesia and the importance of delivering the right drugs at the right time.
- Health care professionals should be acquainted with non-pharmacological pain interventions.
- Health care professionals should be aware that the punctual compliance with the pain management plan, addressing background pain, procedural pain, and anxiety is a necessary condition for adequate pain management.
- Health care professionals should be made aware that pain assessment by means of validated scales is a condition sine qua non, as evidence emphasized that care givers (e.g. nurses) are not able to give a reliable estimation of the patient's pain.

Considerations

- Guidelines for burn-pain management must be broad in scope to allow for variations in analgesic needs across all patient populations and phases of burn recovery.
- Nurses should continuously and accurately assess the patient's pain and the response to therapy.
- Medication, especially opioids, should be regularly evaluated and adjusted to achieve maximum effect and minimal side effect.
- The nursing role is the most important in the essential focused surveillance of burn pain and its successful treatment
- Even minor burns are painful and need analgesia.

- Aggressive pain management should be used in the first instance.
- Analgesia should be administered prior to dressing change (1/2 to 1 H).
- Consider anxiolysis in addition to pain medication.
- For the relief of itching antihistaminic drugs can be added.
- The aim should be for the patients to be awake and alert but comfortable.
- Non-pharmacological management of pain, such as active hypnosis, rapid induction analgesia and distraction relaxation may be considered in adjunction to pharmacological therapy.

Audit tools

- Pain scales such as VAS, are commonly used in adult patients in burn care practice, although there is currently no Class I evidence to support the use of any of the yet known pain assessment tools in burn patients. Nevertheless, there is convincing evidence in other patient groups that the VAS is a reliable and valid measure for the assessment of pain.
- Observational behavioural pain assessment scales should be used to measure pain in children aged 0 to 4 years.
- Faces pain rating scale can be used in children aged 5 years and older.
- VAS can be used in children aged 12 years and older.
- WHO guidelines for combination of step one to three pain killers (WHO Pain ladder).

Supporting evidence

In general, there is growing evidence that pain management protocols should be tailored to the individual needs of the patient (Ratcliff et al., 2006). Pharmacological interventions should therefore be fine tuned to the patient's situation and fluctuations in time. Regularly repeated pain assessments can assist in meeting this aim. Next to it, non-pharmacological pain interventions become a necessary adjunctive intervention in the battle to overcome (procedural) pain. The current best available evidence was found for active hypnosis, rapid induction analgesia and distraction relaxation (de Jong et al., 2007). Nevertheless, there is preliminary evidence that also non-pharmacological interventions should be adapted to patient characteristics (e.g. coping style or personality characteristics) (Van Twillert et al. In Press).

A necessary condition for individualized pain management protocols is the measurement of pain. Although in burn care there is a need for validation studies especially in young

children, studies in other patient populations showed that observational behavioural pain scales can provide insight in pain experienced by very young children (von Baeyer and Spagrud, 2007). Reports of current practice (Ratcliff et al., 2006) and a validation study (de Jong et al., 2005) show that this type of scales has been introduced in burn care practice in latest years.

Finally, guidelines are necessary because studies show that information and education alone have little effect on the quality of pain management.

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4.1.3. FLUID RESUSCITATION

Recommendations

- Proper fluid management is critical to the survival of patients with extensive burns.
- Fluid resuscitation needs are related to the extent of the burn and body size.

Considerations

- To prevent hypovolemia and/or burn shock the nurse, in collaboration with the physician, will initiate as soon as possible a safe and accurate fluid resuscitation (if indicated).
- The effects of the fluid resuscitation on the hemodynamic status of the patient should consistently be assessed.
- Titrate Ringers Lactate based on urine output.
- Urine output should be monitored frequently.
- Target values of urine output are: 0,5 cc/kg/hr for adults, 1cc/kg/hr for children <30kg and 1 to 2 cc/kg/hr for high voltage burns.
- No colloids are given the first 8 hours after burns.
- Administer maintenance fluid with resuscitation due to limited glycogen stores in young children.

Audit tools

- Accurate TBSA measurements using Lund & Browder tables and/or rule of nines schedule.
- Patient's palmer surface (hand + fingers) = 1% TBSA.
- Parkland Formula for fluid resuscitation in burns.

Supporting evidence

- Evidence based studies on fluid resuscitation in the literature are numerous.

4.1.4. WOUND CARE

Guideline statement

- Fast wound closure with optimal functional and aesthetic result.
- Preventing infection Sepsis, SIRS, MODS... and, or biofilm formation resulting in less inflammation, better scarring and finally less morbidity and mortality.
- The end result of any wound management will be an expedited wound healing with maximum patient comfort.

Recommendations

- The choice of dressing depends on: cause, size, depth, location, degree of exudation, contamination level and costs. So reflect before use and be creative because there is no clinical directive evidence to support the choice of one dressing over another.
- For secondary healing wounds there is limited evidence that foam dressings have an advantage for patients satisfaction, pain reduction and time of care.
- Topical creams - Should have good antimicrobial effects without the risk for resistance or allergic reactions. They should leave no slough on the wound bed and provide good visibility on the wound bed. They should not dehydrate the wound and on the other hand absorb enough exudates to keep the balance for moist healing without maceration of the surrounding (intact) skin.
- Blisters - Clinical guideline for best practice based on available evidence
Conflicting recommendations and clinical applications have been given concerning best practices for the management of burn blisters associated with partial-thickness burns. Arguments for the preservation of intact blisters centre on the idea of naturally occurring biologic protection whereas the debridement of blisters has been advocated because of the perceived decreases in wound infection and complications.
Recurring themes in burn wound management that are considered in this debate include infection, healing, functional and aesthetic outcome, patient comfort, ease of dressing care, and cost efficiency. The management of burn blisters should be supported by evidence across these six categories, should match the expertise of the provider, and should use the available resources in the practice setting.
- Stress and delayed wound healing - There is evidence to support the relationship between stress and wound healing in different types of wounds. Stress can affect the healing process both psychologically and physiologically. As wound pain can

contribute to psychological stress, measurement and successful management of wound pain could help minimize stress in patients and thus promote faster healing of acute and chronic wounds.

- Wound -tissue temperature - Wound-tissue temperature should be kept above 33°C. Below this temperature fibroblast and epithelial cell activity decreases. The time required by hypothermic cells to resume mytotic cell division should not exceed 3 to 4 hours. Wound bed temperature should be maintained as much as possible during dressing changes in order to maximize healing. Time and frequency of dressing changes should be adapted to this knowledge.

Considerations

By creating the optimum wound environment to enhance wound healing with the use of topical treatment or surgery and hereby seeking for a balance of nutrition, hypoxia, and removal of debris in an occlusive moist environment, with a minimum of psychological stress and pain to the patient.

Supporting evidence

Wound toilet or wound bed preparations are seen as the first step in local treatment of both acute and chronic wounds¹. It consists in the removal of slough, non-vital tissue and necrosis by abundantly cleaning and cleansing the wound with tap water (filtered), saline solution or sterile water in combination with mechanical debridement. It results in bacterial load reduction and stimulation of granulation tissue formation. Use of disinfectants may induce allergic reactions and or irritation, therefore they might even slow down healing. Moreover they have a reduced action in wounds due to proteins, present in the wound bed. There is low evidence concerning the use of disinfectants. Wounds heal faster in a moist environment, it accelerates the breakdown of fibrin and death tissue and prevents cellular dehydration and cell necrosis. It fastens angiogenesis and collagen synthesis and strengthens the interaction between growth factors and target cells. A moist wound environment is less painful, has less infectious risks and finally reduces the costs of care.

The use of prophylactic systemic antibiotics is not supported by evidence.

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4.2. PHYSIOTHERAPY AND OCCUPATIONAL-THERAPY GUIDELINES

4.2.1. OEDEMA MANAGEMENT

Recommendations

It is recommended that the therapist collaborate with the burn team to minimise oedema formation and to assist maximum oedema reduction.

The Therapist should employ suitable oedema reduction techniques to reduce pain, stiffness and contracture. These may include:

- Positioning, compression & mobility rationale associated with oedema reduction.
- Fabrication of devices for patient positioning to reduce oedema eg. foam, thermoplastics, neoprene.
- Design of programmes for joint & limb active / passive movements to minimise stiffness and contractures.

Considerations

The therapist should:

- Understand the principles of vascular & lymphatic circulation.
- Be aware of predisposing factors to oedema formation.
- Be able to assess and grade the type & stage of oedema.
- Be aware of the principles of compression application, and competent to select, monitor & review levels of compression.
- Be aware of the contraindications for compression application.

Audit tools

- Visual observations.
- Palpation.
- Circumferential measurements.
- Volumetry.
- Goniometry & Range of motion.
- Dynamometry.
- Muscle strength.
- ADL assessment.

4.2.2. SPLINTING AND POSITIONING

Recommendations

It is recommended that the Therapist have an understanding of the rationale for splinting, and implement an appropriate splinting regime to prevent contracture formation, damage to anatomical structures and assist graft or skin substitute and /or wound closure.

The therapist should assess positioning requirements and implement a safe & timely positioning programme for the burns patient throughout the recovery period. This should include fabrication of devices for positioning where appropriate

Considerations

The therapist should:

- Understand the principles underlying splint design and fabrication.
- Apply mechanical and design principles during fabrication & application of static & dynamic splints.
- Be aware of the contra-indications, risks and complications associated with splinting.
- Be aware of burn pathology and its relevance to positioning requirements.

Audit tools

- Observation.
- Formation of deformity.
- Goniometry.
- Written documentation.

Supporting evidence

- Requirements for splinting - clinical consensus.
- Duration of use - clinical consensus.
- Positioning of various parts of the body - clinical consensus.
- Positioning after reconstructive surgery - variable, no real consensus.

4.2.3. SCAR MANAGEMENT

Recommendations

It is recommended that the Therapist consistently assess the stage of wound healing and identify the appropriate time for implementing scar management techniques. Scar management regimes and modalities should be implemented with full consideration of patient and caregiver factors. Regular review and reassessment should be carried out to monitor progress.

Considerations

The therapist should:

- Be aware of influencing factors contributing to scar formation.
- Understand the indications for scar management.
- Be competent in the assessment of scar formation using objective and subjective measures.
- Be aware of the indications for choice of treatment modality, and the rationale for clinical use. Treatment modalities may include massage, pressure therapy / silicone gel therapy / facial & neck conforming collars & masks / splinting.
- Be aware of the functional implications of scar formation.
- Be aware of the psychological implications of scarring.
- Be aware of the impact, complications and contraindications of the various treatment modalities.

Audit tools

- Vancouver scar scale.
- POSAS (patient and Observer Scar Assessment Scale).
- Recorded observations.
- Digital photography.
- Standardised functional outcome measures.

Supporting evidence

- Scar assessment - no real consensus but although Vancouver scar scale is still most widely used the use of the POSAS can be recommended while including the patient's opinion.
- Pressure garment therapy - Evidence Based practice in the prevention of thickening of severe burn scars. Optimal level of pressure remains debatable but the higher the level applied and the longer the garment worn per day, the better clinical results that is obtained.
- Silicone therapy - Evidence based consensus for gel sheets in prevention and treatment of hypertrophic scars (in general).

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4.2.4. EXERCICE AND MOBILIZATION

Recommendations

- Mobilize the burn patient as soon as possible, even in the ICU phase.
- The aim of exercise/rehabilitation should be:
 - Restore or maintain range of motion (ROM), strength and physical fitness (endurance).
 - Restore pre-injury (or improve post-injury) mobility e.g. transferring and ambulation.
 - Restore pre-injury (or improve post-injury) functioning in activities of daily living (ADL).
- A multimodal and well functioning analgesia routine is particularly important for the optimization of exercise/rehabilitation.
- A multi-disciplinary approach, with regular meetings focusing on rehabilitation status of the patient, is imperative.
- Use patient-oriented goals and audit tools/quality indicators, signifying and documenting progress at the patient level as well as for the unit.

Considerations

Decreased mortality of patients with high total body surface area (TBSA %) burns has increased the need for specialized rehabilitation. The rehabilitation of the burn patient should start immediately and exercise should focus on ROM, strength, and physical fitness. “Exercise is a universal component of rehabilitation treatment after burn injuries”, although, more high-level studies are needed to confirm the effects of more advanced exercise. [1]

Audit tools

Joint range of motion:	Goniometry [2]
Muscle strength:	Grip strength (Jamar dynameter) [2] Manual muscle testing [2]
Physical fitness:	Shuttle walk test [2] 6 minute walk test [2]

Supporting evidence

The first goal in the rehabilitation process of a burn patient should always be early mobilization. A number of studies have shown the negative effects of prolonged bed rest, such as muscular atrophy [3, 4], contractures resulting in decreased joint mobility [5] and impaired cardiovascular functioning [6]. Schweickert et al. found that early mobilization of ICU patients, on mechanical ventilator, were safe and resulted in “better functional outcomes at hospital discharge, a shorter duration of delirium, and more ventilator-free days compared with standard care” [7]. Mobilization should be initiated as soon as the patient's vital functions are stable [8].

Contractures, affecting joint mobility, are one of the main complications after deep burns [9, 10]. Passive-, active- or active assisted range of motion exercises should be performed daily to maintain joint mobility, depending on the status of the patient. ROM exercises should include non-affected joints, since the prolonged bed rest itself can have a negative effect [3]. It is also important to position the patient in a correct/optimal way (see EBA-guideline, section 4) to prevent the skin from shrinking and consequently joints from contracting. Splinting can also be used to prevent contractures, but opinions differ regarding the effect(s) of static splints [10, 11].

Hypermetabolism and catabolism due to the burn injury/injuries [12] and bed rest can lead to muscular atrophy [3, 4]. Passive ROM exercises, on sedated patients, has shown positive effects on muscle fibre function [13], hence exercising should start immediately. Active strengthening exercises with weights or mechanical/manual resistance are recommended, since they stretch the skin as well as increase muscle strength [14].

Children with burns have shown a higher increase in strength with exercise than treatment with exogenous growth hormone [15].

Literature also suggests that high-intensive resistance and fitness exercises (70% three repetition maximum and 80% maximal heart rate), after final grafting, are safe, and increase both strength and aerobic capacity [16], although larger studies are required. Studies show negative effects on physical fitness, regardless of type of injury, after hospitalisation [6, 12]. These effects have been shown after hospitalisation periods as short as five days [17]. Therefore it is recommended to start aerobic exercises (active, active assisted or passive), as early as possible in the acute phase [18].

Patients with severe burn injuries often experience weakness and fatigue due to loss of muscle strength and aerobic capacity. This often leads to difficulties with activities of daily living [19]. It is important that strengthening and aerobic exercises are combined with (training) activities of daily living, like eating, dressing and maintaining personal hygiene [20].

To be able to walk or ambulate independently, and achieve a normal gait, is an important goal for many burn patients. Beside the positive effects of early mobilization, mentioned earlier, it also increases independence in functional activities and prevents decubiti [14]. Correct positioning, in earlier phase, and proper dressing and wrapping with elastic bandages (to prevent oedema and support capillaries) can facilitate walking [14].

Pain management in burn patients is vital to gain optimal rehabilitation. Adequate pain management can be achieved by a continuous assessment and evaluation, of both pharmacological and non-pharmacological treatment, by a multidisciplinary team (see EBA-guideline, section 1). [21, 22]

Multi-disciplinary burn teams first appeared in the 1950s-60s [23] and have been a standard of care ever since. The multi-disciplinary approach should be used in all phases of the rehabilitation, and meet on a regular basis to assess the needs of the patient. The occupational- and physiotherapist, in collaboration with the other team members, are essential for optimal rehabilitation of the burn patient [12].

Patient participation in the rehabilitation is central. Important components are individualized programmes, involvement in goal-setting and meaningful outcomes [24]. Rehabilitation should aim to regain the highest possible level of autonomy, through maximal participation by the patient [25].

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Strength:	Dynamometer, grip and pinch
Dexterity/Hand function:	The Michigan Hand Outcomes Questionnaire (MHQ) Canadian Occupational Performance Measure (COPM) QuickDASH
Scarring/Itching:	The Patient and Observer Scar Assessment Scale (POSAS) The Vancouver Scar Scale (VSS) Burns Itch Questionnaire (BIQ)
Sensation/Cold intolerance:	Semmes Weinstein monofilaments
	Cold Intolerance Symptom Severity Questionnaire (CISS)

Level of evidence

During the acute phase, exercise and positioning of major joints are often prioritised. However, overlooking adequate hand rehabilitation in early stages can complicate the rehabilitation process towards restoration of hand function [1]. Deeper burns will, despite early grafting, form contractures without proper preventative therapies [10].

Maintaining ROM is vital to restoring hand function. Important factors in maintaining ROM are exercising, oedema control and positioning/splinting. ROM exercises should be performed frequently, there is unfortunately no consensus regarding frequency and duration. Active ROM exercises are recommended before passive- or active assisted. However, when full ROM cannot be reached actively, passive exercises are necessary. Patients should be trained in how to perform passive ROM exercises, if possible. However, due to the anatomy of the dorsum of the hand, therapist should be aware of possible extensor tendon injuries in deeper burns and avoid composite flexion in those cases [1, 3]. All tendon or joint injury has to be taken into account when training ROM [1, 3, 5].

The importance of grip strength in hand function is sometimes debated [11, 12], however, strength exercises should be implemented in the overall hand rehabilitation [3, 4, 13]. Studies have shown that burn depth is a factor in loss of grip strength after hand burns. Patients with deep partial and full-thickness burns regained normal pinch strength, five

years post-injury, while grip strength remained decreased [14]. In contrary, patients with deep full thickness burns showed significant decreases (up to 50%) in both pinch- and grip strength [11].

Deterioration of hand function and ADL function after burns is not uncommon. The level of disability often correlates with the depth of the burn [11, 15, 16]. Specific dexterity and ADL training should be implemented in the rehabilitation and it is important that ROM and strengthening exercises are combined with (training) activities of daily living, e.g. eating, dressing and maintaining personal hygiene [3, 4, 17].

Elevation, above heart level, with extended elbow is important to minimise oedema. Elevation can be combined with external wrapping or pressure garments for extra effect [1, 3, 18, 19]. As soon as the patient is able to actively participate in the rehabilitation, active pumping exercises should be performed. For more information see EBA-guideline 4.2.1. *Oedema management.*

A burned hand without any form of movement will, depending on burned areas, get contractures and deformities such as claw hand deformity, web space contractures and palmar contractures [1, 10]. Active and passive ROM exercises, positioning and splinting can be used to avoid contractures. The claw hand deformity is a hyperextension of the metacarpophalangeal (MCP) joints, flexion of the proximal interphalangeal (PIP) and distal interphalangeal (DIP) joints and adduction of the thumb. An optimal splint, for claw hand deformity, should aim to keep the hand in an intrinsic-plus position: wrist extended 20° to 30°, MCP joints flexed 70° to 90°, PIP and DIP joints fully extended, and the thumb in palmar abduction [1, 3, 4, 10, 18]. In active patients, splinting during the night is often sufficient. Even though splinting is considered a standard in burn rehabilitation further studies are needed to fully understand the effects of splinting [5, 20, 21]. For more information see EBA-guideline 4.2.2. *Splinting and positioning.*

Scars, especially hypertrophic scars, can affect a patient both physically and psychologically [22]. The standard treatment for scar prevention is compression therapy. Even though, considered a standard treatment, evidence is conflicting [23]. Compression can be applied

with elastic bandaging or pre-/custom made compression gloves. Gloves should be used as soon as wounds are healed. Other commonly used treatments are silicone therapy, scar massage and laser treatment [17, 23]. However, despite the numerous scar treatment methods, few studies have been adequately powered [23]. For more information see EBA-guideline 4.2.3. *Scar management*.

Peripheral nerve disturbances from burn injury and skin grafting can lead loss of sensation, hypersensitivity and cold intolerance [9, 24]. Sensory re-education and desensitisation should be used to restore sensation and minimise hypersensitivity [24].

Pain management and multi-disciplinary rehabilitation teams are essential for optimal rehabilitation. For more information see EBA-guideline 4.2.4. *Exercise and mobilization* and 4.1.2. *Pain management*.

Patient participation in the rehabilitation is central. Important components are individualized programmes, involvement in goal-setting and meaningful outcomes [25]. Outcome measurements should be multidisciplinary, not only focusing on physical areas. Falder et al. describes seven domains that could be used as a framework: Skin, Neuromuscular function, Sensory and pain, Psychological function, Physical role function, Community participation, Perceived quality of life [6].

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4.3 REHABILITATION GUIDELINES

4.3.1 PREPERATIONS FOR DISCHARGE FROM A BURN CENTRE (ADULT PATIENT)

Recommendations

- Soon after admission to the burn centre patients and their families should be informed about the length of stay as well as the treatment and multidisciplinary team approach.
- During hospitalization length of stay, the intermediate goals and priorities in rehabilitation may be adjusted, and it should be communicated to the patient.
- The primary goal in burn care should be optimal self-care. Therefore, it is important to work towards independence and self-reliance as soon as possible. Goals should be discussed with the patient and family and agreed with the interdisciplinary team.
- To ensure that patients are discharged at an appropriate time and with provision of adequate post-discharge services, an individualized discharge plan should be developed.
- Discharge planning leads to less readmissions and improves the quality of life for the patient.
- The time of discharge needs to be evaluated by the multidisciplinary team together with the patient and family and depends on wound healing, overall health status, Activities of Daily Living (ADL) independency, mental status, the family's ability to care and the situation at home.
- Readiness for discharge should be assessed as part of the preparation for discharge.
- All members of the burn team should understand that a thorough preparation for discharge is an important factor for the wellbeing of the patient at home.
- Each professional involved in the recovery of the patient should inform the patient and develop contact with external agencies to make sure that the patient receives the right treatment following discharge.
- Preparation for discharge teaching requires verbal instructions, demonstrations of care techniques, time for questions and written instructions and illustrations. These instructions emphasize important points of care and should be adjusted to cultural background and cognitive ability of the patient and their careers.

Considerations

Patients with burns often face a difficult and uncertain time leaving the safe environment of the burn centre. It is important to give patients and family enough time to adapt the idea of going home. The burn team must be aware of the fact that these changes may cause many questions, uncertainties and fears.

To perform a smooth transition discharge planning is needed. Before the patient is medically ready for discharge, the burn care team must have determined the most appropriate setting for ongoing care. The functional and social aspects of the patient's illness will determine where they are discharged to. The patient's acute and chronic medical conditions, potential for rehabilitation, and decision-making capacity must be taken into account.

Input will be required from multiple sources to determine the most suitable discharge plan. Involved parties will include the patient, family and the all members of the burn team, including a case manager.

In order for the patient to be deemed safe and ready for discharge to home or to a rehabilitation centre, a provider must take into account a number of factors beyond the medical determinants. These factors include:

- Patient cognitive status
- Patient activity level and functional status
- The nature of the patient's current home and suitability for the patient's conditions (e.g., presence of stairs, cleanliness)
- Availability of family or companion support
- Ability to obtain medications and services
- Availability of transportation from hospital to home and for follow-up visits
- Availability of services in the community to assist the patient with ongoing care

A readiness for discharge assessment should be part of discharge preparation for every patient and those who are less ready may benefit from rescue strategies to avert adverse outcomes.

The readiness for hospital discharge scale according to Weiss [14] contains 4 attributes of patients' perceptions of readiness for discharge:

1. Personal status (pain or discomfort, strength and energy)
2. Knowledge (about medications, restrictions, follow up, and information about services available),
3. Coping ability (to perform medical treatments, rehabilitation, medication management and personal care and to handle the demands of life at home), and
4. Expected support (emotional, help with personal care, household activities and medical treatments).

The way the discharge teaching is given is very important for the patient's perception of discharge readiness too. Delivery of teaching that includes particular attention to listening and answering, sensitivity to personal beliefs and values, clarification, consistency, scheduling at times convenient for the family to attend, focusing on anxiety reduction, and confidence building improves patients' perceptions of their readiness to go home. The combination of verbal and written modalities for presenting information for discharge has been recommended.

Caregivers must be aware of the fact that good patient education means to empower the patient and family. This leads to trust in the ability of self-care, improves independency and patient compliance. It reduces uncertainty and anxiety.

All disciplines involved in the burn care so far, should inform the patient in their own fields and develop contacts with external agencies to make sure that the patient receives the right treatment at home. During a multidisciplinary meeting within the team the subject should be discussed who provides the patient with what kind of support. Nurses will teach the patient and family how to care for the wounds at home, or will transfer this care to a district nurse. A discharge summary will be written to inform the district nurse. It is possible to add pictures, drawings, or a film, made during the wound care procedure to show the wound and how to apply the dressings. A smart phone can be used to do this. The nurse, FT and OT will stimulate the patient in ADL training and self-care.

In case of severe visible burns, a burn nurse should accompany the patient when they leave the burn centre for the first time. This offers support when encountering strangers.

The patient and carer will be provided with information about:

- Wound healing, wound care
- Skin care, vulnerable skin, blisters
- Scar formation, limitations in movements, pressure garments
- Scar care such as massage, silicon application if available and necessary
- Splints with indication when and how long to wear
- Daily program on mobilization exercises
- Pain (medication, relaxation and breathing techniques, distraction, etc),
- Itch (medication, lotion, cool environment etc)
- Fatigue, reduction of general health
- Exercise
- Nutrition
- Do's and don'ts (sports, swimming, sun protection etc)
- Psychological effects (distress, concentration loss, poor sleep, fear)
- Relation with family, friends, strangers (how to handle the altered appearance)
- Role within the family (rediscover the balance in-between the family)
- Role at work (see chapter back to work)
- Peer contact

Extended information about the psychological problems patients (and family) might face at discharge will be given by the psychological team. Items that might be discussed are: rediscovering the balance in-between relations, family, work, trouble in accepting the scars and other consequences of the burns (like depression, post-traumatic stress disorder etc) . The contact might be continued in the outpatient setting. Either patient has possibility to continue with psychological support at the outpatient clinic or he should have the information where he can get help in case he needs psychological support, wants to get in contact with support groups etc.

At discharge practical information will be given on paper, like the date for a visit to the (multidisciplinary) outpatient clinic, telephone number whom to contact in case of problems and questions, etc. The burn centre might provide the patient with an aftercare brochure and an evaluation form, to examine the patients' satisfaction with the given care.

Audit tools

Checklist for discharge [16] (attachment 1)

Evaluation form to examine the satisfaction about provided care.

Supporting evidence

Since a burn injury is often a devastating event with long-term physical and psychosocial effects, it is important that all members of the burn team contribute to a thorough preparation before discharge. A specialized multidisciplinary aftercare team for burns is needed too, because patients often face a reduced generic health, caused by both physical and psychosocial limitations. [1,13]

Discharge planning is the development of an individual discharge plan for the patient prior to leaving the hospital, with the aim of improving patient outcomes and containing costs.

Discharge planning should ensure that patients are discharged from hospital at an appropriate time in their care and that, with adequate notice, the provision of other services will be organised. A structured discharge plan tailored to the individual patient might bring about a reduction in hospital length of stay and readmission rates, and an increase in patient satisfaction [2, 15].

Family support is very important during the preparation for discharge and the rehabilitation phase at home or elsewhere. In many cases it will lead to a quicker recovery and a better outcome of quality of life. For a rehabilitation regimen to which family members can and will adhere, culture specific attitudes, beliefs, norms and behaviours must be considered. Misunderstandings rooted in cultural differences often result in wrong intake of medication, not attending to follow-up visits etc [3].

As mentioned before support from family, friends and health professionals is essential for burn-injured persons, for the return to society, pre-burn activities and a meaningful life. Nurses have an important role in facilitating the presence and involvement of family and friends in the recovery and rehabilitation. Once at home, new bodily limitations of patients demand assistive others. Patients often describe the supportive actions from others as positive, but it could also be experienced as challenging, and sometimes even unwanted and interfering with the struggle for regained freedom. [4, 5]

Near hospital discharge most frequent nursing diagnoses among the family members of adult burn patients are knowledge deficit and anxiety. The former is characterized by the family members' need for information about care for the burned areas and infection prevention. The feeling of anxiety is mainly related to the changes in the appearance,

structure or function of the burned patient's body and to the family members' expectations with respect to the patient's return to the family and work environment, accompanied by some physical, psycho-emotional or social consequence. [6, 7]

It is important anticipating family members' perceptions about the patients' problems in order to promote strategies that will improve patient care after hospital discharge. [8]

Before discharge nurses should be aware of psychological problems like nightmares, re-experience of the accident, signs of depression and acute Post Traumatic Stress Disorder. Psychological assistance should be offered in the hospital and/or in the outpatient setting. [9]

Caregivers have to be aware that patients living alone have lower outcomes in quality of life after burns. Other risk factors are unemployment, having non-burn physical illness, psycho-logic disorders, chronic pain, or having sustained full thickness injuries [1]

Patients and close family members often experience substantial emotional trauma, not always related to burn size or severity. Emotional distress is highest amongst people with facial burns. Once at home patients describe physical otherness, memories of consuming, embodied pain, and recycling of the initial catastrophe. Family members express vicarious suffering and are confronted by the physical otherness of their loved one. Both patients and family members are isolated in their "bubble of trauma" as they try to contain grief and loss, and protect loved ones from their distress. Emotional trauma persists after discharge challenging family functioning and adjustment. [10]

Ultimate success or failure of patient compliance with discharge teaching program depends on the ability of the patient and/or family to correctly adhere to the instructions of the teaching program provided prior to discharge. Therefore, the teaching program must be clear, concise, individualized to meet the needs of the patient at home.

Many studies suggest the use of patient education to increase patient compliance. By decreasing anxiety about recovery through education, pain was decreased and compliance was increased. Active involvement of the patient in establishing goals and expectations during and after discharge improves patient compliance with teaching regimes.

Patient education programs require:

- Verbal instructions to patient and family that include goals of care, techniques of care, equipment etc

- Demonstration / return demonstration of recommended care techniques
- Time allowed for questions and answers
- Written instructions emphasizing important points of care with names and phone numbers of whom to call for assistance. [11,12]

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4.3.2 DISCHARGE CHECKLIST

			Yes
Inform patient			
Inform family			
Contact external agency			
Transport			
CPR policy (ambulance)			
Discharge conversation			
Wound care materials or prescription			
Pressure garments			
Evaluation forms			
Written information	for patient	for district nurse or rehab centre	
Discharge summary including reason for admission, co morbidity, operations etc.	x	x	
Condition at discharge (functional and cognitive status)		x	
Recommendations of any sub-speciality consultants	x	x	
Wound care instructions	x	x	
Pictures of wounds etc	x	x	
Aftercare brochure	x	0	
Discharge medication	x	x	
written schedule	x	x	
comparison with pre-admission medications	x		
include purpose and cautions	0		

Any anticipated problems and suggested interventions	x	x	
Follow-up appointments (date, address, telephone number etc)	x		
24/7 call back number	x	x	
Peer contact organisation	x		
x = required			
o=optional			

4.4. PSYCHO-SOCIAL GUIDELINES

4.4.1. ANXIETY

Recommendations

No specific treatment recommendations for burn patients can be made due to the lack of controlled studies. However, research suggests that single-session debriefing of hospitalised patients will not aid and might even contribute to posttraumatic stress disorder (PTSD). Other forms of psychological treatment have not been evaluated. It is therefore recommended that professionals addressing anxiety-related problems follow the general guidelines for treatment of anxiety symptoms and disorders. Such guidelines have been devised by the National Institute for Clinical Excellence (2005) and the Swedish Council on Technology Assessment in Health Care (2005).

The following considerations and suggestions for tools are based on clinical reasoning and research studies of risk factors for poor adjustment. Due to the lack of treatment studies, the considerations are focused on assessment and screening.

Considerations

Professionals addressing anxiety-related problems should:

- Be integrated into the team of burn care professionals during in-hospital care and during outpatient care.
- Be aware of the complex interplay between physical and psychological factors that contribute to anxiety.
- Be competent in assessing burn-specific pain anxiety.
- Consider the use of non-pharmacological pain interventions in adjunction to routine pain management in order to reduce pain-related anxiety. Be competent in the assessment of anxiety symptoms and anxiety disorders in general and PTSD in particular.
- Assess lifetime psychiatric disorders and anxiety-related personality traits as these appear to be risk factors for development of PTSD.
- Assess symptoms of anxiety on a regular basis during in-hospital care and during outpatient care.

- Have knowledge about possible treatment options and either 1) be able to apply adequate treatment (for instance pharmacological or psychotherapeutic treatment) or 2) recommend referral to available psychological and/or psychiatric care.

Audit tools

- Symptom checklists.
- Hospital Anxiety and Depression Scale (HADS).
- Impact of Event Scale-Revised (IES-R).
- State Trait Anxiety Inventory-State version (STAI-S).
- Burn Specific Pain Anxiety Scale (BSPAS).
- NEO-Personality Inventory (NEO-PI).
- Swedish universities Scales of Personality (SSP).

Diagnostic interviews

Structured Clinical Interview for the DSM-IV Axis I Disorders (Anxiety module - containing the PTSD module).

Clinician-Administered Posttraumatic Stress Disorder Scale.

Supporting evidence

There is one randomised controlled study of psychological treatment (Bisson et al, 1997). It was a single-session debriefing of hospitalised burn patients (n = 103) that showed an adverse effect of treatment at one year follow-up. However the treatment group was not equal to the no treatment group concerning baseline levels of symptoms. There are no replication studies concerning debriefing and no other forms of psychological treatment have been properly evaluated.

Prospective studies with structured clinical interviews and self-report instruments suggest that previous psychiatric problems, deviant personality traits, early symptoms of anxiety and pain-related anxiety are strongly associated with PTSD or PTSD symptoms later in recovery (Dyster-Aas et al., accepted; Fauerbach et al 1997; Fauerbach et al 2000; Lawrence & Fauerbach, 2003; Van Loey et al., 2003).

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4.4.2. DEPRESSION

Guideline statement

The impact of a severe burn injury on the individual is enormous and multi-dimensional, beginning at the moment of injury, through hospitalization and extends throughout that person's life, thus requiring a bio-psychosocial multidisciplinary approach. Recovery from burn injury typically requires extensive and painful physical rehabilitation¹⁻². In addition, a major burn injury can cause considerable damage to skin integrity, often leading to hypertrophic scarring and functional and aesthetic sequelae²⁻³, which impact on several dimensions of patient's life (namely, familiar, professional, emotional, aesthetic and functional status). These conditions may put patients who suffered serious burn injuries at particular risk for depression. Depression is a psychological disorder with various levels of intensity and complexity that may continue present for several months and even years after discharge³, with consequent deterioration of quality of life.

Physical and emotional problems interact and complicate treatment outcomes, thus emphasizing the importance of providing optimal treatment for the physical illness without neglecting the concurrent psychological distress⁴. Depression has a significant prevalence in burn patients as a consequence of their injury and impact on their lives⁵.

Identifying and managing signs and symptoms of depression is an essential part of the burn patient's recovery and rehabilitation processes. Management of depression by specialists is essential to optimize well-being and quality of life and prevent future problems.

Psychological support and specialized psychotherapy helps patients to cope and adjust better at each phase of their recovery process and thus foster physical recovery, well-being and quality of life, therefore should be integrated as part of routine burn care⁶.

Risk factors for Depression:

Various studies ⁷⁻²¹ identified a number of different predictors of post-burn depression, including:

- Past history of emotional disturbance, namely, pre-burn depression.
- Personality (neuroticism, trait anxiety and hypochondria).
- Psychiatric history.
 - Poor psychosocial adjustment.
 - Alcohol and other substance abuse.
 - Self inflicted burns.
 - Medical illness.

- Behavioral self-blame for the burn accident.
- Employment status at the time of the burn.
- Pain intensity.
- Physical disabilities, mental status and social adaptability.
- Female gender (especially in combination with facial and/or breast disfigurement).
- Burn visibility (namely head, neck and hands burns).
- Maladaptive coping strategies.
- PTSD.
- Loss of function.
- Prolonged stay in hospital and complicated surgical course.
- Symptoms of depression in the hospital.

Recommendations

- Early screening routine procedures for depression regularly during hospitalization and after discharge to assure accurate diagnosis, effective treatment and follow-up (adapted guideline from b).
- Accurately assess and treat depression, which needs to be highly individualized and frequently adjusted according to the burn patients' specific needs 15,32.
- Adequate assessment and management of symptoms of depression require the availability of specialized staff in psychosocial care and eventually a specialized clinical service for consulting and referral after discharge.
- Depression treatment requires psychological intervention or a combination with medical/ psychopharmacological treatment depending upon the severity of the disorder (adapted from a).
- Identify patients at risk for depression or poor psychosocial adjustment after discharge and refer them to specialized care for monitoring and preventive or treatment strategies 33.
- Counseling should be available to patients and families both during hospitalization and after discharge as a way to minimize problems and maximize well-being 20.
- Availability of comprehensive follow-up services with specialized care including psychological support and care should be made more accessible to burn-injured patients post-hospitalization 31.

Clinical guidance on depression and its treatment can be consulted at:

- <http://guidance.nice.org.uk/CG23/niceguidance/pdf/English>
- <http://www.ahrq.gov/clinic/3rduspstf/depression/depressrr.htm>

Specific recommendations

- Careful evaluation of psychiatric disorders in burn patients is needed as soon as their clinical state allows 22.
- Establishment of clear communication between patient and staff so that the patient has the best understanding possible of the nature of the injury and the treatment, allowing the patients as much control as possible in the treatment process 23.
- Cognitive-behavioural interventions reduce depression 8.
- Pain assessment and management are needed 14.
- Patient with facial and hand scars are forced to deal with disfigurement, grieving the loss, and to adapt to the new image, and must receive particular attention for preventing/reducing emotional impairment 24.
- Psychotherapeutic intervention must also be provided for the patient with hidden scars, especially the young woman with breast scars. Group therapy can play an important role in providing this necessary support 25.
- Psychologists should promote and support patients' involvement in clinical procedures.
- Patients with an abnormal psychological profile - including suicidal ideation – should be given special attention, adequately monitored and regularly followed by appropriate mental health professionals 25.
- Evaluate if depression can be related to neuropsychological problems (frequently associated with electrical injuries 8. In this case neurological and neuropsychological evaluations should be conducted to better define sequelae and treatment targets of ELI 26.
- Practical advice given in the form of staff-led discussions, before or immediately after discharge has been shown to be much useful for patients 18.
- The role of the psychologist includes direct assessment and psychotherapeutic intervention with the patient and liaison with the surgical and nursing staff 27.
- Psychologists can provide training in communication skills for staff members, helping them to prevent and deal with depressive symptoms.

Audit tools

Screening tools has been found to be most effective and minimally burdensome for patients. Literature suggests that a reasonable method would be to initially screen for depression with a short screening tool (PHQ-2, with 2 items), which have been validated in primary care settings 28-29 (or others, followed by a more thorough screening tool, such as Patients Health Questionnaire 30 or clinical one as Beck Depression Inventory. If screening is positive, referral for a mental health professional for clinical evaluation and management of depression is required 2.

Screening for pain and anxiety should also be conducted.

Questionnaires used for adult patients	Aspects evaluated
Patient Health Questionnaire (PHQ-2)	Screening for Depression Depression
Zung self-rating depression questionnaire	Anxiety and Depression
Hospital Anxiety and Depression Scale	
Brief Symptom Inventory (BSI)	Psychological morbidity
Beck Depression Inventory	Depression
General Health Questionnaire	General Health+depression
Center for Epidemiologic Study Depression Scale	CES-D
Hamilton Depression Rating Scale	Depression
Burn Specific Health Scale	Quality of life and Health status in burn patients
Patients Health Questionnaire (PHQ-9)	Depression
DSM-IV-R Structured Clinical Interview	Psychiatric Disorders

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- <http://www.ahrq.gov/clinic/3rduspstf/depression/depressrr.htm>
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4.4.3. DELIRIUM

Recommendations

- Delirium should be monitored on daily basis in critically ill burn patients, and scored on a delirium instrument documented in the patient chart least twice a day
- Pathophysiological states, i.e. deviant blood tests, should be optimally corrected
- A weaning protocol should be implemented as early as possible in burn patients needing ventilator support
- To avoid over- or under-sedation, targeted levels of pain and sedation should be individualized and prescribed for each patient
- Pain and sedation should be monitored by standardised patient-reported scales, or behavioural pain scales in patients unable of self-report
- Pain medication should be prioritized before sedatives, and light sedation is recommended if not contradicted by the condition of the patient
- Early exercise and mobilisation should be instituted
- Sleep and rest should be facilitated, by controlling light, noise, pain, discomfort, and the feeling of being “trapped” by tubes and lines; and by minimizing stimuli
- Offer single rooms as far as possible to patients at risk, and avoid unnecessary transitions between rooms inside the ward
- Patients should be informed before procedures, i.e. personal care, or manipulation of tubes and lines
- Continuous information and orientation should be given on place, time and situation, and a clock, calendar, eye glasses, hearing aid, and a windows allowing for natural day-night cycle may be helpful
- Include relatives and offer them information on delirium

Considerations

Delirium is Latin for ‘going off the ploughed track’ and has been described as ‘brain failure’. For decades, a state of acute confusion has been seen as a normal part of illness severity in patients in need for intensive care treatment. Today, delirium is recognized as a serious complication to intensive care, and associated with increased mortality, and more adverse outcomes and costs. Thus, an increasing effort to prevent, monitor and treat delirium has been seen the last 10 years. Nurses are in a key position to detect delirium, and modify the condition, for instance by careful sedation monitoring and management (1).

The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) states that in order to be diagnosed with delirium, a patient must show all 4 of the following features (2):

1. A disturbance in attention (i.e., reduced clarity of awareness of the environment) is evident, with reduced ability to focus, sustain, or shift attention. This disturbance in consciousness

might be subtle, initially presenting solely as lethargy or distractibility, and might be frequently dismissed by clinicians and/or family members as being related to the primary illness.

2. A change in cognition (such as memory deficit, disorientation, language disturbance) or the development of a perceptual disturbance not better accounted for by a pre-existing or evolving dementia.
3. The disturbance develops over a short period of time (usually hours to days), represents an acute change from baseline, and tends to fluctuate during the course of the day.
4. There is evidence from the history, physical examination, or laboratory findings that the disturbance is caused by the direct physiological consequences of a general medical condition, substance intoxication, or substance withdrawal. The changes in attention and cognition must not occur in the context of a severely reduced level of arousal, such as coma.

Three clinical subtypes of delirium have been identified (3). These include:

1. Hyperactive delirium - a condition where a patient might have heightened arousal, with restlessness, agitation, hallucinations, and inappropriate behaviour
2. Hypoactive delirium - a condition where a patient might display lethargy, reduced motor activity, incoherent speech, and lack of interest
3. Mixed delirium - a combination of hyperactive and hypoactive signs and symptoms.

The term subsyndromal delirium has also been used to define partially resolved or incomplete forms of delirium. Hyperactive delirium is more often associated with hallucinations and delusions, than hypoactive delirium which is more often associated with confusion and sedation (4).

Audit tools

Confusion Assessment Method – Intensive Care Unit (CAM- ICU) (5)

Intensive Care Delirium Screening Checklist (ICDSC) (6)

Delirium Observation Screening Scale (DOSS)(7)

Level of evidence

Delirium affects up to 80% of intensive care unit (ICU) patients treated on a ventilator, and about 20-50% of non-intubated ICU patients (1). The majority of burn patients (77%) treated on ventilator experience delirium for an average of 3 (1-6) days (8), and of these patients 71% experienced hypoactive delirium, whereas hyperactive and mixed delirium were seen in 6% and 22%, respectively. The occurrence of delirium in an adult burn population, suffering from a mean TBSA: 9%, has been reported to be 13.1 % (9). Despite this high incidence, there is a tendency among intensive care nurses and physicians to underestimate the occurrence of delirium (10, 11), with hypoactive delirium as most susceptible of being unrecognized (12, 13). Subjective assessments of delirium also include a danger of misinterpreting patients' symptoms, i.e. of pain or anxiety, as being signs of delirium (13).

Screening tools has shown to increase the likelihood of detecting delirium, and to provide an interdisciplinary foundation for monitoring and treatment. The “Confusion Assessment Method for the ICU” (CAM-ICU) and the “Intensive Care Delirium Screening Checklist” (ICDSC) are the most reliable and valid screening tools for delirium in critically ill patients (4). A recent comparison between the two screening tools suggests that the ICDSC is more appropriate than CAM-ICU in the burn intensive care unit (BICU) population (14). This finding may be supported by another study which suggests that the ICDSC is a better screening tool in the surgical patients in ICU (15). CAM-ICU is more dependent on a patient-observer interaction than the ICDSC, which may be difficult in the severely ill. On the other hand, CAM-ICU has been documented to a better predictor of outcome in the general intensive care population (16). Another screening tool, especially developed to facilitate early recognition of delirium based on nurses’ observations in regular hospital wards, is the Delirium Observation Scale (7). The suggested screening tools are all based on the DSM criteria for delirium, but further investigations are needed to identify the best screening tool for use in the burn population. In general, critically ill patients who are at moderate to high risk of developing delirium, e.g. because of alcoholism, cognitive impairment, hypertension, severe sepsis or shock, on mechanical ventilation, or receiving parenteral sedative and opioid medication, should be systematically monitored by using a screening tool each nursing shift (4).

Delirium is more common in mechanically ventilated patients than non-mechanically ventilated patients (1). Most likely, this may be explained by several factors, including disease severity. But mechanical ventilation also increases the need for sedative medication. Benzodiazepines have been reported to be the strongest risk factor for delirium in surgical and trauma ICU patients (17). Also in burn patients, higher doses of benzodiazepines have been associated with the development of delirium, while higher doses of opioids seemed to have a protective effect (8). Notably, while opioids for treatment of pain seems to prevent delirium, high doses of opioids used for sedation has shown detrimental effects (18). Thus, delirium prevention should include a routinely monitoring pain and sedation by the use of validated assessment tools to support pain management and sedation-minimizing strategies (4). Sedation strategies may include awakening and breathing trials, or light sedation protocols. A weaning protocol should also be implemented as soon as possible in patients needing mechanical ventilation.

Early physical and occupational therapy have been shown to give shorter duration of delirium and fewer days on mechanical ventilation in a medical intensive care unit (19, 20), while restraints or devices precluding mobilization increase the risk for delirium (21). Early mobilisation is also recommended within a burn intensive care unit (22).

Noise levels in a burn intensive care unit that are higher than what is recommended (23) may have a negative impact on psychological health and sleep. Intensive care patients sleeping with earplugs have reported better sleep quality and less delirium or mild confusion (24). Even though the evidence showing a link between sleep and delirium is sparse, enhancing sleep through noise reduction, by normalizing day-night rhythm, and by enhancing patient comfort and relaxation are recommended (4, 18). While orientation techniques are often applied in confused and delirious patients in the intensive care units, the value of acknowledging the patient's own reality for reducing stress has also been a suggested method(25). Moreover, family visits may be of great value (1).

Overall, the evidence of effects from pharmacological prevention or treatment strategies for delirium is still weak (18).

An ABCD model is proposed in order to prevent and reduce the duration of delirium in Intensive Care Units. This bundle approach includes, Awakening and Breathing coordination, Choosing sedatives that do not increase the risk of delirium, Delirium monitoring and management and lastly Early mobility and Exercise (18). Implementation studies in burn patients are still needed.

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4.4.4. QUALITY OF LIFE - ADULTS

Recommendations

- Burn professional should acknowledge patient perceived quality of life as the main aim for burn care next to survival.
- Active participation in the multi-disciplinary team is recommended, and regular meetings focusing on the quality of patients' lives should be arranged.
- It is recommended that burn care members have an understanding of important factors contributing to patient perceived quality of life in order to improve the individualized care.
- In achieving the best possible care, quality of life should be assessed from admission to the end of rehabilitation. In the most severely injured, this may include life-time follow up.
- It is recommended on regular bases to evaluate the quality of burn care by systematic assessments of quality of life outcomes on a patient population level.

Considerations

According to the World Health Organization, quality of life is defined as “individuals’ perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations standards and concerns.” Moreover, it is considered to be a “broad ranging concept, incorporating in a complex way individuals’ physical health, psychological state, level of independence, social relationships, personal beliefs and their relationships to salient features of the environment.”

This multi-dimensional character of quality of life highlights the importance of the competence of each member of the burn-team, together with routines for close and continuous collaboration through all phases of treatment and rehabilitation.

It is generally agreed that quality of life is a subjective phenomenon, based on values and dynamic, and most reliably assessed by asking the patient. Thus, quality of life in a clinical perspective supports individualized care.

Audit tools

Disease specific health:	BSHS-B (1)	
Generic health:	SF-36 (2)	
	EQ-5D (3)	Health-Related Quality of Life
Overall quality of life:	SWLS (4)	(HRQoL)
	QLQ (5)	
	QOLS (6)	

Supporting evidence

Quality of life has been described as a continuum of increasing biological, social and psychological complexity. From physiological aspects, to symptoms, which again impact on functioning, and general health perception, and lastly on the evaluation of overall satisfaction or happiness with life. Moreover, characteristics of the patient, e.g. coping mechanisms, and characteristics of the environment, e.g. economy and social support, influence on all levels from symptoms to overall quality of life (7). In this conceptualization, subjective health status and quality of life are distinct constructs, but strongly related. In the burn literature, the terms disease-specific health, generic health status, health-related quality of life, and quality of life are used interchangeably. As indicated under the heading audit tools, we suggest “health status” for questionnaires mainly asking for symptoms and functioning, and “quality of life” when asking about an evaluation of life as a whole. The use of generic health status and overall quality of life instruments allows for the comparison with other groups of patients or norm populations. Consequently, it may be of value to use disease-specific, generic health status and overall quality of life instruments in combination.

Physiological factors: After burn injury, the extent of body surface area burn, the localization of burn, full thickness injury, and number of surgical interventions are documented physiological factors associated with subjective health status (8-10).
Symptoms: Pain, itch, heat sensitivity, temperature intolerance, and sleep difficulties are commonly reported symptoms associated with subjective health(11, 12). Furthermore, mental health challenges, like psychiatric symptoms prior to the burn (13), delirium while hospitalized (14), body image dissatisfaction and traumatic stress disorders (15, 16), represents all major threats to patient wellbeing. Written diaries together with consultations has been proven to reduce incidence of post-traumatic stress after critical

illness (17). Accordingly, written diaries together with follow-up consultations would most likely improve quality of life in burn injured after critical care.

Functioning: Compared to general population norms, complex functioning, both physical and psychosocially have been reported to be more challenging than self-care activities after burns (6, 16). Accordingly, aiming at social reintegration and return to work after discharge from burn injury, is very important for long term quality of life.

General health perception: The overall evaluations of health is influenced by all the before mentioned factors and is reported to be impaired compared to general population norms in burn centre populations more than 2 years after discharge(6, 16).

Overall quality of life: Overall quality of life is reported to be lower than general population norms measured at discharge and at 6 months after, but comparable to general population norms in average 4 year after injury (4, 6). Furthermore, satisfaction with life in a broader concept than health is impacted more by burn patients mental health than physical health (4, 5). But notably, both non-burn physical illnesses and psychological illnesses may represent a threat to overall quality of life (6).

Lastly, characteristics of the person, e.g. neurotic personality traits and avoidant coping, in addition to factors related to the environment, e.g. housing and marital status, has been documented to be important factors related to self-perceived health and quality of life outcomes (4, 6, 18, 19). Moreover, patient perceived traumatic growth such as general optimism, self-efficacy, perceived social support, should also be recognized and supported by the burn team (20).

To summarize the quality of evidence, it is a lack of intervention studies aiming at patient reported quality of life in burn care. Accordingly, interpretation of descriptive studies, together with clinical experience and consensus forms the rationale for best practice. Even so, written diaries and psychosocial follow-up consultations after discharge from a burn centre should be considered to be part of standard burn care. Moreover, the multi-dimensionality of quality of life calls for a team-approach through all phases of burn treatment and rehabilitation.

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4.4.5. RETURN TO WORK

Recommendations

- It is recommended that burn care members have an understanding of important factors contributing to patient return to work in order to improve the individualized care
- Burn professionals should acknowledge patient return to work as an important factor for patient wellbeing, self-perceived health and quality of life
- A multi-disciplinary team approach and regular meetings focusing on enhancing the ability of patients to return to work are recommended
- The burn team should acknowledge the value of family, social network and workplace as valuable contributors of practical and emotional support for the patient
- Ideally, all working-age patients should be offered an individualized vocational rehabilitation plan, and a professional counsellor who can guide patients in the return to work process.

Considerations

A person's ability to work can be profoundly affected by the physical, mental and social impact of burn injury. A considerable number of patients will need both an extended time off work, and work accommodations in order to return to work. Work is on the other hand important for the economic situation of patients, as well as for their perceived health and wellbeing. Thus, systematic multidisciplinary vocational rehabilitation ought to be an integrated part of total burn care.

Audit tools

Return to work rates

Return to work time

Supporting evidence

Return to work rates after burn injuries vary across studies from 14 to 91 % with a 66 % mean return rate at the final follow up [1]. Lower employment rates in average 4 years after injury compared to the general population have been documented [2]. After 3.3 years, the majority (72 %) of previously employed burn injured persons seems to return to work [3], with a substantial number returning to work within the first year post-injury [3]. Even

so, a need for work changes or accommodations, like limited work hours, limited number of work days, or light duty, seems to be relatively common [3]. Hitherto, facial burns have not been linked to work rates, but one study indicates a possible relationship between facial burns and need for job changes [1].

The extent of full thickness burn, number of operations, and length of hospitalization, have been reported to be associated with both the return to work and the time it takes to return to work [3-5]. Total body surface area burned, hand burns and personality disorder seems to mostly affect the time to return to work [3, 5]. Several studies document a close relationship between patient self-reports of functional ability, disease-specific and generic health status and work status [2, 4-7]. Furthermore, self-reports of appearance, pain, anxiety disorder and the personality trait embitterment, and a history of substance abuse and psychiatric disorders, have been found to be associated with work status after burn [3, 5-7]. Job-related factors also seems to be important, such as type of work, type of health insurance, and employment status at time of injury [3]. Burn patients returning to work have been reported to be younger than the non-working group [6]. Lastly, barriers to return to work seem to change over time, from wound issues and physical abilities the first months, to work conditions and psycho-social issues on the long-term [3]. Even so, the difference between the employed and unemployed has been documented to be greater in physical health domains than the psychological 1-6 years after injury [7]. Notably, the unemployed demonstrate lower scores than the general population on all aspects of generic health and overall quality of life [2, 7]. Thus, work seems to be very important for patient self-perceived health and wellbeing.

Qualitative studies, have revealed that burn injured experienced individual characteristics, like the ability to take action and setting up goals as important [8]. Furthermore, the social life, the health care and rehabilitation, the work place and Social Welfare Agencies, were categories experienced as important facilitators for successful return to work. But each category also included possible barriers e.g. in terms of disappointment, not being understood, not being informed, or treated without compassion. The possibility of getting modified work tasks or changed work place was an important facilitator. Ceasing pain medication, lack of knowledge in primary health care facilities on wound care, lack of individual rehabilitations plans and psychological support were experienced as barriers [8]. Another qualitative study of 23 patients identified four typologies of work experience

after burns: Defeated, burdened, affected, unchanged or stronger[9]. The authors recommend increased focus on the three first groups.

Successful community integration of adult burn patients includes rehabilitation aimed at return to work. Even so, to our knowledge, intervention studies are still lacking in the burn population.

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4.4.5. WORKING WITH PARENTS/SIBLINGS

Recommendations

General:

- Individual counselling sessions
- Family counselling sessions
- Family-burn team consultations
- Life management counselling

Acute phase:

- Offering space and time to the family to express feelings, emotional reactions on the accident,
- Normalizing the parents'/siblings' reactions on and explanations of the accident •
Giving appropriate information about burns and treatment in general in all possible ways (written materials, videos, photos, books, story books, play, etc.), and reinforcing understanding of explanations
- Promoting the family's possible and helpful involvement in the care
- Assisting in the process of redefinition of family roles
- Promote strategies to keep the family's everyday routine and social life
- Advising the parents how not to overlook each other as spouses and their other children (special time to one another)
- Helping the family activate its own adequate coping strategies, and offering new ones if needed
- Helping the family activate its own ability to care and support
- Helping the parents/siblings find positive aspects of their situation and avoid catastrophizing
- Positive influence of the parents/siblings expectations regarding outcome of burns.

Around discharge:

- Address issues related to stigma and altered appearance
- Involve parents or siblings in the general care, including skin and wound care in due time
- Prevent and focus on minimizing discharge anxiety
- Provide necessary access to professional support, i.e. access to home care service, after discharge

- Determine the right time of discharge based on an assessment of the family's ability to care

Rehabilitation phase:

- Help the parents/siblings adjust to the altered appearance of the child with burns
- Advise parents/siblings how to handle difficult social situations (e.g. curiosity or reactions of others seeing the scars of the child with burns, name-calling of play mates etc.), and how to foster these skills in the child
- Help the parents avoid attitudes that could cause the child's social isolation
- Take part in and manage the cooperation between parents and school
- Encourage parents to seek professional help at home, and to access avenues of social, financial support available in their local government and other possible institutions
- Provide access to aesthetic, cosmetic rehabilitation tools

Considerations

The burn injury of a child affects all the areas of her/his family's life, functioning and dynamics. The family members may face profound psychological, emotional, social and financial consequences of burns [1]. In supporting the family's coping, we reach out to our young patient, too, since the family is the primer model of coping, and the main source of his/her social and emotional support.

In order to help the family cope, continuous psychosocial support should be offered: reaching from the burn unit admission of the child on through discharge and outpatient stage. Psychological and social support offered by the team of the burn unit should seek to promote cohesion, reduce conflict and increase stability of the family so that they could adequately respond the challenges of burns [2]. The interventions should be adapted to the individual needs and development of the patient and her/his family, and should pay special attention to the culture the patient lives in.

Around discharge, first of all the issue of the stigma of burns, adjustment to the altered appearance of the patient should be addressed by the psychosocial team of the burn facility.

Besides on-going psychological and social support, discharge anxiety (DA) of the child and her/his parents and siblings should be assessed and treated if necessary [2, 3]. Previous possible and helpful involvement of parents/siblings in the general care including skin and wound care, seem to have both emotional and practical advantages [4]. It can give positive feelings to parents and siblings and balance their negative emotions related to the injury, and is a good way to prepare home care of the patient.

Family-burn team sessions can be offered to the family focusing on education of the parents/siblings on skin/wound care issues. The preparation of the family for home skin/wound care should begin in due time. Nevertheless the family should be accessed to a home care service in order to provide professional assistance in skin/wound care issues while home stay.

A family support service could assist at determining the right time of discharge by an assessment of the family's ability to care, the home hygiene and home safety.

Child protection aspects and activities in this field are determined by the current child protection law of the each individual country. The family support service of the burn unit should be available for the families of burned children to provide social assessment and parental support, and to investigate the possibility of neglect or abuse [5]. In all cases of paediatric burn injuries it must be investigated whether the injury was accidental or is a result of neglect or abuse [5].

Audit tools

Parents

- IES (Impact of Event Scale).
- HADS (Hospital Anxiety and Depression Scale)

Siblings

- KIDSCREEN.
- CHQ (Child Health Questionnaire).
- CBCL (Child Behaviour Checklist).

Supporting evidence

Most of the burn injuries children experience take place when the child is with some relative, i.e. mother (26%), both parents (12%) or other relatives (18%) [6]. In cases of burn injuries in children, mothers seem to be at higher risk than children for developing psychological sequelae, and this can impact the child's outcome and compliance with treatment [7]. Mothers of burned children very often suffer from guilt feelings and elevated levels of anxiety and depression which are not related to burn severity but to the period in hospital, the complications that might occur [7], and social factors [8].

The family members of a child with burns share the trauma and some consequences of the injury: they must cope with their own emotional reactions on the accident and treatment such as anxiety, traumatic stress and depression [9]; they face the changes of their life rhythm and social life, and certainly the impacts of hospitalization. The family is also challenged to set new priorities in order to appropriately respond their child's increased needs for care and attention on long term. The parental personality seems to have a crucial role in the burned child's adjustment, and the family seems to be the main source of the child's social and emotional support. The attitudes of the parents and siblings related to the burns appear to be the primary model of the patient's coping and adjustment. The child's adjustment, in return, impacts family functioning and parenting stress [9]. All these challenges of the family's commitment, acceptance, dedication, responsibility put at risk the interfamily relationships and the cohesion of the family.

On the other hand, the burns of their child and her/his special care needs can negatively impact the social and financial status of the family (e.g. employment of the parents; all family members can be stigmatized by the burns of their child/sibling etc.). A survey conducted by Williams and Griffiths (1991) indicates that practical advice in the form of staff-led discussions, before or immediately after discharge, would be the most valuable help [10].

The interventions recommended seek to address these challenges and help the family respond in a constructive way. There is little evidence to support these recommendations, but they are all based on descriptions of best practice of European and North-American burn units/centres shared in literature, and personal experiences [8,9].

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4.4.6. BACK TO SCHOOL

Recommendations

General:

- The child and family should be given an explanation of the school reintegration service offered by the (psychosocial) burn care team.
- A plan should be developed for the young burn patient's way back to normal life, including a school reintegration program aiming to facilitate the disfigured child's transition from the protective hospital environment back into the school setting
- Preparation should begin as soon as possible, including assessment of the developmental level, coping styles and needs of the child, and the needs of the family. Information and support should be individualized according to their specific situation.
- Planning includes the burn care team/psychosocial team, the patient (if appropriate), teachers and family
- Each patient is encouraged to return to school soon after hospital discharge
- Accompanying the child on the first school day
- Burn team professionals offer continuous consultation to the school
- If the child moves to a different school during their treatment (e.g. to senior school or a move to a different geographical location) provision should be made for continued school support. The new school should be offered the same reintegration service [1].

Preparing the child:

- Individual support sessions for the child and their family [1] to explore their thoughts and feelings about their accident, worries around being discharged from hospital and the transition to normal life. (This work could be supported by the use of diaries, a "photo bank", videos, booklets and books)
- Group support sessions for children and young people who have experienced a burn injury -Introducing fellows or mentors to promote understanding in the community, to offer support and to model positive social interaction.
- Group support sessions for children and young people with shared experience e.g. hospitalisation, pain, visible difference. This type of interaction can provide a safe space to meet and discuss the reactions of others to any visible difference and to gain confidence by practicing a positive response to questions and challenges.

- Accessing all paths of social support available in the local and wider environment of the child that can contribute to their appropriate social reintegration.

Preparing the school:

- The burn injury's impact on the child's learning abilities
- The child's special needs
- The child's planned treatment in the outpatient stage as a cause of further school absences
- Ways of support for teachers that can be accessed in order to respond this challenge
[2]

Continuous contact with the school:

- Allow any concerns about school absences to be addressed.
- Assure that the child's learning needs continue to be monitored and a special education plan is produced if necessary (by the corresponding institution of the country).
- Ensure that provision is made for homeschooling if needed.

Return to school visit with pupils:

- Visits are especially important in case of visible scarring in the child
- Educate on causes and types of burn injuries, and about what to do in the case of a burn injury
- Educate about what happens when the injured person comes to hospital and what procedures and interventions are used (demonstration of bandaging with the help of two young volunteers). All pupils and teachers try physiotherapy exercises and get to see pressure garments and splints.
- Discuss about what makes us different, how we are similar, what skills and qualities make us special, how we might feel returning to school after a burn injury and how we might like to be treated.
- Puppets, photos, videos, booklets can be used to present the material and to interact with the class.

Return to school visit with the teachers/staff:

- Visit before the child reenters school
- Educate about what are most common causes of burns, how best to respond and a discussion about the risks of certain behaviours (e.g. smoking and aerosol use);
- Educate about what happens to our skin when we get burnt. What procedures and interventions are used when a patient comes to hospital;
- Discuss about stigma in society, how value is placed on appearance and what our views are on this;
- Discuss about how we might feel returning to school after a burn injury and how we might like to be treated.
- The presentation ends with a quiz and work-stations with demonstrations of bandaging, physiotherapy exercises, pressure garments and splints.

Considerations

It can be difficult for a child to return to school after their burn accident as each child will have been through a great deal. Especially those children who have post-burn scars often have to deal with teasing, name calling, even bullying. This can affect the child's self-esteem, confidence and academic performance. It has been found that lack of information, understanding and familiarity with burn scars lead to this victimization, which again results in a tendency to reject and withdraw from the child, ultimately in the social isolation of the child [3].

The school reintegration program can be realised on two levels:

- Level 1. Preparing the child for school re-entry: The preparation should start as soon as possible[4]. Prior to every plan for any support of the child, an assessment of the developmental level of the child and the needs of the family [1,2] should take place. Also the coping styles of the child and family should be assessed in order to give the right amount of information and appropriate support. Children should be supported to explore their strengths and weaknesses post-injury and to use their ideas and skills to update their sense of who they are. It is possible that they will need help to balance any frustrations relating to their burn injury by acknowledging and encouraging their abilities, talents and interests [1]. It is also possible that the child or young person may have concerns about appearance; a program of support should be offered to help them

generate strategies to cope with these concerns and move forward in a positive way. The professional support offered to the child should consider the exploration of positive expectations as well, strengthening a positive attitude through goal setting, activities and achievements [1]. It discovers the child's natural coping style and helps him/her to find ways to build on this. The support should be given in a whole child perspective[5].

- Level 2. Preparing the SCHOOL for the patient's return: In every case of a child's burn injury, a first step is to inform the school of the accident. Close contact with the school should help the school management team, the teachers and pupils recognize the school's special role [2] as an avenue of informal support for the child in their social reintegration; as a source of self-esteem and belonging. The above mentioned school visits seek to promote understanding, compassion and respect, prepare the school in a practical sense - arranging for safe movement between lessons without being injured (e.g. plans for the use of stairs if classrooms are not on the ground floor and mobility is a problem, arranging for skin creaming routines to be undertaken). Lastly to prevent burns in others by giving appropriate informations about burns and treatment in general. Accompanying the child on the first school day - can be offered, if the child needs it. It is a good way to reassure the child of the psychosocial team's constant support, and to check the classmates' understanding of the problem.

Audit tools

Time to return to school.

A feedback from child, family and school should be sought informally and through structured feedback forms.

Supporting evidence

Research evidence suggests that rehabilitation services for children with burns that include a school reintegration program may profoundly support their return into the community [6], and contribute to an acceptant and constructive environment which allows human growth. In paediatric burn patients who opted for school reentry visits, the burn injury had less negative impact, they returned to school soon after hospital discharge, and functioned as well or better after injury. Little decrease in their performance was noted, and only those children with problems in school before the burn injury had problems after the burn injury [7].

Our school reintegration programs can enhance a positive sense of self-worth in a child who has been burned. The premise of these programs is that cognitive and affective education about children with burns will diminish the anxiety of the patient with burns, the patient's family, faculty and staff of the school, and the students[8,9].

Individualized school reintegration programs vary according to patients' and their families's needs and capacity of burn team. They should always regard children's different levels of physical, emotional, and intellectual development (preschooler, the school-age child, and the adolescent) [5] and the culture the patient lives in. The support offered to the whole child [5], family and community should reach throughout inpatient, discharge and (the years of) reconstruction/rehabilitation stage of care.

School reintegration programs seem to be implemented in most of the European burn facilities, and, according to our everyday experience, they are popular and effective. Little evidence is provided to support our practice though.

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4.5. PEDIATRIC GUIDELINES

4.5.1. PEDIATRIC OCCUPATIONAL THERAPY

Recommendations

Recovery of manual skills and dexterity

- Positioning and static splinting
 - Contracture prophylaxis of affected joints through positioning in splints or other available devices/material as early as possible. Devices should be applied over the dressing if necessary in the acute phase. Thereafter, the splints should be continuously readjusted to the current possible ROM. For circumferential areas the positions should be alternated.
 - During the acute phase of the patient's sedation and inactivity it is advisable that the splint is worn day and night.
 - Once the child is awake and may be active again, splints should be worn at night only and if necessary for certain periods of inactivity and rest.
- Mobilization and dynamic splinting
 - Early passive mobilization under anesthesia and later in the course, whenever possible under analog-sedation – CAVE: cautious and careful mobilization in respect of the very vulnerable tissue structures
 - For passive mobilization with the child, that is awake, the consideration of pain and stress factors is imperative and the implementation of stress reduction measures are crucial (refer to *pain-management* below)
 - Passive mobilization should be continued in children as long as needed

Active mobilization exercises as well as meaningful and attractive activities as soon as possible

- Dynamic splinting with maximal, but very careful stretching of scars over joints. Splints should be worn 30-60 min per day, when possible 3 times daily. The scar-areas over joints must be prepared with specific scar massage and scar mobilization.
- For circumferential areas of involvement, alternating the position and slow and controlled stretch is indicated.
- Scar management
 - Scar care through creaming twice a day and daily scar mobilization
 - Application of silicon, if available
 - Compression therapy, if available with compression garments otherwise by elastic wrapping, with foam, particularly in concavities

Pain- and stress management

- In conjunction with painful occupational therapy measures, depending on age, personality, individual pain processing and coping strategies, resilience, a variety of non-pharmacological stress reduction approaches should be considered, such as

distraction, imagery, hypnosis, relaxation techniques, comfort positioning during painful procedures as well as age-appropriate information and illustrations. (refer to *Guidelines and recommendations on non-pharmacological approaches in painful procedures in children*)

- Child-oriented occupational therapy by involving the child in activities suitable for that individual child while aiming at the functional goal.

Recovery of selfcompetence and selfcare skills according to the child's age

- As active mobilization in children is challenging or even impossible due to the age of the child, attractive activities that involve high level of hand function are imperative in a pediatric hand therapy.
- Re-education of selfcare skills according to the child's age
- Facilitation of play and re-discovery of the individual's skills

Enablement and involvement of parents

- Continuous, attentive parental information and orientation about therapeutical considerations and goals
- Involvement and enablement of parents in specific aspects of the treatment, such as passive mobilization, splinting and scar management, meaningful and purposeful activities for their child
- Parental coaching, supervision and support according to their needs (refer to *Guidelines and Recommendations on Diversity of patient families*)

Discharge, re-integration and out-patient setting

- Parents of the patient should be ready, able and confident to continue with the instructed hand therapy including splint- and scar management well before discharge. They must know when and where to address in case of uncertainties and complications or when splints cause pain.
- As children grow, splints and scars must be repeatedly and periodically re-evaluated and re-adapted. The professional monitoring of scars and splints must be organized, either with the burn center and/or an adequate professional near the place of residence of the patient's family.
- The child's selfcompetence, occupational performance, manual skills as well as selfconfidence and quality of participation in social activities must be explored and evaluated repeatedly.
- Support during re-integration on site at school, in the social environment of the patient.

Considerations

The treatment of children after burn injury requires very specific considerations. One has to be aware of the vulnerability of a child, the lack of experience to cope with threatening situations, being highly dependent in every aspect of life and being a child means having a skin that grows, yet scarring skin does not grow the same speed as the uninjured skin does. Therefore, children are prone to develop contractures. Children need their parent's support, care and comfort. It is therefore essential to address both, child and his/her parents.

The aim and core of pediatric occupational therapy is the recovery of the child's ability to perform his/her own meaningful occupation and participate in play, in his/her social milieu, at school, in leisure. Hand burns are very common in children and due to the high complexity of hand function a challenge to treat in general, yet in children even more aspects have to be considered.

Audit tools

In rehabilitation of pediatric burn injury, outcome measures should be focused on the child's ability to re-engage themselves in their core occupations, play, explore, their age adequate self-care and ability to participate at school.

Assessment tools:

- Canadian Occupational Performance Measure (COPM a kids) with Activity Cards
- Child Occupational Self-Assessment (COSA)

ROM: Goniometer

Strength is only measurable in older children: Dynamometer

Supporting evidence

Contracture in conjunction with burn scars lead to loss of ROM and if not treated, to severe deformity. In all phases of burn rehabilitation (acute, intermediate and specially in children also long term) positioning and splinting are core issues. [1,2,3,4]

Dynamic splinting as well as controlled passive mobilization provide and enforce the elongation of the scar area. Depending on their age, active mobilization is sometimes difficult or impossible to get in children, unless they are caught in activities they like. Yet, even if they really get active in their play, they can do almost everything with their first 3 or 4 fingers. They very often neglect their fifth digit, which therefore needs close attention in maintaining flexion of the MP joint. [5, 6]

Procedural pain is a strong overshadow in treatment of burn patients. Being aware of the vulnerability of a child as a patient this is a dilemma all professionals are confronted with.

As the elongation and positioning of scarring areas as well as the involvement of the affected hand into activity is crucial, pain with stress and anxiety is difficult or impossible to avoid. Yet, beside pharmacological measures there is a variety of effective approaches to address pain, anxiety and the relating stress, such as simple, age adequate distraction and diversion, imagery and hypnosis, relaxation technics, comfort positioning during painful procedures as well as age-appropriate information and illustrations. Although further research on non-pharmacological approaches is needed in pediatrics, the available evidence and practical experience is promising. [7, 8, 9]

It is most important to involve children as early as possible into activities corresponding to specific functional considerations, but are meaningful and pleasurable to the individuals, such as play, crafts, games, even cooking or baking. Those simple activities not only have a great effect on re-gaining hand function, dexterity, self-competence and self-confidence but also enhance stress-reduction. [10,11, 12]

According to their own resources and capabilities parents should be involved and enabled in the specific burn care for their child. An honest and optimistic attitude is helpful for the challenging and distressing course the parents have to undertake with their child. [13, 14]

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4.5.2. DIVERSITY OF PATIENT'S FAMILY BACKGROUNDS IN PEDIATRICS

Recommendations

- Requirements for a competent diversity process in regard to the cooperation with parents
 - Cross-cultural competency, i.e. defined as the ability to effectively deliver health care services that meet the social, cultural, and linguistic needs of patients
 - Recognition of diversity and dynamic change in society as well as the potential cultural differences and/or social and socioeconomic factors that may influence behavior and identity
 - Understand the impact of migration and exile on individuals and families
 - Recognition of ways discrimination may emerge
 - Ability and readiness to look at situations from more than one perspective
 - Recognition of differences and similarities
 - Self-reflection and understanding of own cultural contexts, attitudes, values, beliefs, pre-assumptions
 - Avoidance of cultural determinism/cultural attribution in regard to the individual's needs
 - Avoidance of culturally and ethnically stereotyping
 - Ambiguity tolerance – the ability to withstand uncertainties
- Steps in the professional diversity process in relation with the patient's family
 - Recognition of differences without judgement
 - Perception and exploration of similarities without judgement
 - Mutual clarification of goals, abilities, resources and needs by involving a variety of perspectives (professional, family, child/teenager)
 - Question and address personal and organizational biases, institutional structures, that facilitate discrimination
 - Clarification of family's expectations, beliefs, experiences, hopes and priorities for their injured child
 - Provide a safe room and the necessary intimacy for prayers or spiritual retreat, support in finding spiritual care according to the family's spiritual or religious needs, which were enquired directly from the family itself
 - Recognition of religious food regulations and taboos
 - Definition of a common ground, based on similarities (even if similarities seem very simple and basic), where mutual respect and trust may be developed as a basis for a strong and sustainable collaboration
 - Working towards consensus with individuals and families, by involving and educating parents to allow them to take part in the decision-making process

- Deliver instruction and information in appropriate ways (linguistically, educationally)

Considerations

Based on the necessary family-centered care in pediatric care and assuming the importance of a very close cooperation with parents of pediatric patients the recognition of the diversity of patient families at a burn center is crucial for the course of treatment. Individual life stories, religion and ideologies, migration, family and child rearing concepts, understanding of illness, disease and health, socioeconomic status and educational level have an impact on interaction and collaboration with a patient's parents.

Diverse values and beliefs, communication problems as well as the family's expectations, the parent's feelings of guilt, worries and fears can lead to substantial misunderstandings and influence the further course of treatment and most possibly also the outcome.

Audit tools

- Questionnaires and guided interviews on diversity competency regarding the burn care service delivered.
- Outcome measures in pediatric burns that take into account the issue of diversity and its challenges.

Supporting evidence

In pediatric burn-care, it is acknowledged that parents hold the key to their child and should be included into the course of treatment. It is also widely recognized that professional sensitivity, attitude and conduct regarding diversity of family backgrounds paves the way for the collaboration with parents or whoever from the child's family is in charge to take care for the injured child in the course of treatment during hospitalization and after discharge. Yet more specific research on the presumable significant impact by the patient's family as well as the diversity of individuals and families is required. [1- 6]

A team in pediatric burn care has the profound aim and intention to treat all patients with equal care, without bias, but in regard to the individual biography and background. Yet, patients from diverse cultural, socioeconomic backgrounds as well as family concepts, gender, age challenge the team in their attempt to meet the individual specific needs. Health care professionals in cooperation with medical-anthropologists and cross-cultural psychologists and professionals in social science are in process to define sustainable steps in diversity process towards diversity and cross-cultural competency. In regard to the very specific situation of children after burn injury, much more research is needed. [7 - 10]

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4.5.3. PAINFUL PROCEDURES NON-PHARMALOGICAL APPROACHES IN IN CHILDREN

Recommendations

- Mindful and child adequate communication:
 - Providing an ambiance of calmness, comfort and hope as far as possible with a mindful choice of words and a calm voice
 - Responding promptly to child's pain in empathic, practical and professional manner
 - Explaining in child-oriented language
 - Encouragement of parent/caregiver to remain with child until the pain is under control (if this is not possible for a parent, try to convince the parent for her/his responsibility as a comfort giver in certain situations).
- Introduction and instruction in non-pharmacological pain management strategies
 - Exploration of the adequate method for the individual child (this can vary, depending on individual preferences, stage of treatment course and on daily conditions etc.)
 - Relaxation technics (belly breathing, mindfulness and body scan, guided imagery)
 - Distraction methods (bubbles, hidden-object-games, memory games, virtual reality, computer games – yet avoid competitive and level bound games as they increase stress level)
 - Pediatric Hypnosis and introduction of self-hypnosis to the child or teenager or parent
 - Combination and variation of those methods and technics may be useful
- Child appropriate information
 - Age- and child-adequate information, illustration and instructions describing the planned procedures, according to the child's situation
 - Roll-play with dolls, stuffed-animals etc.
 - Explanation of pain-processing and how it can be influenced, according to the child's intellectual development
- Pediatric Occupational Therapy
 - Enhancement of self-competence, ability for self-care and autonomy
 - Facilitation of the child's idea of "magical helpers" that may be crafted with support of occupational therapy
 - Exploration and development of new skills

- Functional goals embedded in meaningful and pleasurable activities for the individual child (play, crafts, even cooking or baking)
- Support for child appropriate environment regarding privacy and personality as well as the possibility of social interactions and play

Considerations

In the course of burn rehabilitation with children, non-pharmacological pain management is crucial. Regardless of pharmacological measures, anxiety and stress in expectation of pain in relation with mobilization and splinting measures remain strong enough to have great impact on the course of rehabilitation. The pain and stress management must be tailored to the individual child, according to her/his age, developmental and emotional situation, priorities and wishes, daily conditions, experiences etc. The recommended measures are applicable for all professionals in pediatric care, such as nursing care, physiotherapy and occupational therapy in the context of their very own professional field when treating a child in pain. Some of the approaches are merely a necessary professional attitude in the field of stress, anxiety and pain, others, such as pediatric hypnosis and relaxation technics, require further education.

Audit tools

As pain is a subjective experience, individual self-reporting is the preferred method for assessing pain. For children who cannot communicate this information due to age or developmental status, observational and behavioral assessment tools such as the POCIS (pain observation scale for young children) as well as the COMFORT behavior scale (COMFORT-B) are reliable and valid to assess or observe the pain in young children with burns [1, 2] or the FLACC (Face, Legs, Activity, Cry, Consolability scale) are acceptable alternatives when valid self-report is not available. The Poker Chip Scale, where the child may quantify her/his pain with the amount of poker chips or the OUCHER where the child may rate her/his pain intensity by matching it with a photograph of other children's faces are other possibilities when the child is not ready to use an analog visual pain scale, such as an Smiley Analogue Scale for children from 5 years onwards and the VAS from 8 onwards. [3]

Supporting evidence

Anxiety, fear of pain, feelings of loss of control and impaired autonomy is experienced by many children during their hospitalization. Stress and anxiety in association with frequent, painful treatments in relation with burn injuries as well as long hospitalization with repetitive invasive procedures show adverse effect on the skills that the child acquired before the accident. Acute stress reactions in children range from complete withdrawal to aggressive behavior and early involvement of pain- and stress management measures is of the utmost importance for the rehabilitation, further development and re-integration of the child after severe burn injury. In addition to hindering a child's ability to cope, stress can influence wound healing. [2 - 6]

The individual child- and age-appropriate information for reduction of pain, anxiety and stress in association with painful procedures as well as a relaxation techniques, mindfulness, distraction, pediatric-hypnosis as well as meaningful activity have been proven to be effective. But certainly, questioning the efficacy of all the mentioned methods in regard to children with burn injury a lot of further specific research has to be done, including all further variables apart from age such as cultural and social family background, resilience etc. [7 – 16]

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THIRD PART

BEST PRACTICE GUIDELINES FOR BURN PRACTITIONERS

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INTRODUCTION

This section of EBA guidelines aims at assisting burn practitioners, surgeons, intensivists and anesthesiologists, who provide care to severe burn patients.

It reflects the current medical knowledge in the field of burn care and summarises the evidence concerning burn mortality, morbidity and patient reported outcomes.

The appropriate management of the burn patients remains a major challenge. The present guideline should be viewed as an educational aid to improve and standardise the care of the severe burns across Europe and beyond. A multidisciplinary approach, the implementation of locally adapted treatment algorithms and the adherence to evidence-based guidance are the key to improve the quality of the treatment after severe burn injury.

METHODS

This section was developed by a multidisciplinary team, including surgeons, intensivists and anesthesiologists all around Europe on behalf of EBA (List of contributors).

In developing this section the team members took into account the fundamental principles of the guideline developing methods (1–4), identifying the main clinical questions, searching for evidence and making judgements and recommendations using a consensus process among the team and finally sharing them with the European burn care community.

1. Identification of the main clinical questions

The starting point for the identification of the key clinical topics and the main clinical questions was the synthesis of the current evidence in the field of burn care, as stated in previous released international burn care guidelines (5–8). The critical appraisal of those guidelines was realised by a different working group of burn care professional, following the AGREE method, under the supervision of methodological advisers (Appendix A). Their work provided the basis for the further recommendations' development.

2. Literature search

Literature searches were performed using the indexed online database MEDLINE/PubMed, supplemented by the screening of reference lists of relevant publications. The aim of each search was to identify randomised controlled trials (RCTs), non-RCTs and systematic reviews that addressed specific scientific questions. In the absence of high-quality scientific support, case reports, observational studies and case control studies were also considered. Limitations of the search results included “humans” and “English language”. The period was limited to 5 years if the query was considered in the previous burn care guidelines; for new queries, the period was limited to 5 to 10 years depending on the number of abstracts identified by each search. Abstracts identified were

screened by the authors and, if considered relevant, full publications were evaluated.

3. Formulation of the recommendations

Balancing the methods' principles (1–4), the awareness that there is still a lack of high-quality evidence in burn care (9) and the need for a straightforward, clear and actionable language in clinical practice (10,11), in writing the recommendations the team adopted:

- “we recommend” for strong recommendations
- “we suggest” for weak recommendations.

Strong recommendations reflect the group's high confidence that the benefits of the proposed action outweigh the undesirable consequences (regarding mortality, morbidity, patients reported outcomes or costs) according to the available evidence.

Weak recommendations express the group's judgment that, even though available evidence about the topic is insufficient to strongly recommend a particular action, the proposed action is at the moment supported by the current clinical practice and the expert opinions.

Publication and dissemination

The medical section of EBA guidelines can be downloaded as PDF-files from the EBA homepage. The guidelines were presented to a broad audience at the EBA congress 2017 in special sessions.

Scheduled review

The medical section of EBA guidelines will be reassessed every 2 years by a designated EBA multidisciplinary team. The team will adapt the previously released recommendations to new scientific evidence if indicated and address further uncovered clinical areas.

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INITIAL MANAGEMENT OF BURN WOUNDS

In this section, 2 main questions are asked:

1. What are the main concepts for burn wound management?
2. What is the optimal management of circumferential burns?

1. What are the main concepts for burn wound management?

a) Aims of burn wound management

Recommendations

- We recommend that burn wounds are closed as soon as possible and that steps are taken to limit pain, prevent infection and maximise function and cosmesis

Rationale

There is a well-established link between time to healing and the risk of developing hypertrophic scars in both adult and paediatric patients (1–4), and for this reason, the aim should be to close burn wounds as soon as possible. Early wound closure also minimises the need for repeated dressing changes and limits pain and psychological distress.

b) Pre hospital burn wound management

Recommendations

- We recommend removing burnt clothing (unless it is stuck to the patient)
- We recommend removing any jewellery, which may be constrictive
- We recommend that initial first aid is performed by applying cool running water to the burn wound for 20 minutes. Care should be taken to avoid hypothermia, especially in children
- We suggest that the burn wound is covered with a non-adherent simple dressing in the pre hospital environment. Plastic food wrap (polyvinyl chloride film, "cling film") is a good option for pre hospital dressing
- We recommend that the patient is kept warm and transported to a suitable medical facility for expert assessment of the burn wound

Rationale

Appropriate first aid reduces pain and can limit the extent and depth of the burn injury by reducing intradermal temperature and potentially preserving the zone of stasis (5). First aid with cool running water for 20 minutes within 3 hours of injury improves outcome including the length of stay, need for surgery (6) and

decreased the amount of scarring in an animal model (7). Cooling gels have been used providing less effective cooling (8).

Members of the public and non-specialist physicians should be advised against the use of other methods of first aid including the use of ice (9) or the application of substances such as toothpaste, egg or butter which can be detrimental to the burn wound. The use of topical creams should be avoided in the pre hospital setting as it may interfere with later evaluation of the wound.

c) Wound management in the burn centre

Recommendations

- We suggest that all burn wounds are assessed by an experienced clinician
- We suggest the use of Lund and Browder charts for accurate burn size estimation in adults and children
- We recommend that all patients are treated in a suitable environment with consideration given to ambient temperature, comfort, and analgesia
- We suggest that adjuncts to clinical assessment are used where appropriate and available e.g. Laser Doppler Imaging for mixed depth burns
- We suggest thorough documentation of the burn wound and subsequent management including clinical photography

Rationale

Patients presenting to the burns centre should have their wounds cleaned and assessed in a timely manner. The burn wound should ideally be documented with the use of clinical photography to allow the wound to be reviewed by other clinicians without unnecessarily disturbing the newly applied dressing.

Burn wound management, including cleansing and dressing, can be painful and cause patients significant psychological distress. This should be minimised by explaining the procedure to the patient and communicating throughout the procedure. Various non-pharmacologic interventions (e.g. hypnosis, virtual reality or other distraction techniques) can be used and have been shown to be a useful adjunct to pharmacological analgesia. In particular, non-pharmacological interventions have been shown not only to lower pain and anxiety scores but also to reduce time to healing (10–15).

Laser Doppler Imaging (LDI) is an effective and objective tool for measuring blood flow to the burn wound and predicting time to healing which can be used as a surrogate measure for burn depth (16). It should ideally be performed between day 2 and day 5 post burn together with careful clinical assessment for the most accurate results. The use of LDI can reduce the time to decision making and surgery and therefore reduce the length of stay, time to healing (17) and provide cost savings (18).

Currently, LDI is the main technique of perfusion imaging, but there are studies into the use of thermal imaging (static or dynamic) for the measurement of burn depth (19–21). It is likely that a combination of clinical assessment, LDI, and thermal imaging will prove the most accurate measure of burn depth and healing potential.

2. What is the optimal management of circumferential burns?

Recommendations

- We recommend that the burn patient is carefully assessed, looking for circumferential burns
- We recommend that semi-sitting position (elevation of torso) is maintained in case of chest or abdominal circumferential burns
- We recommend that affected limbs are elevated
- We recommend that breathing, signs of abdominal hypertension and circulation of peripheries are assessed at regular intervals
- We recommend that escharotomies are performed when circumferential burns compromise breathing and/or circulation or cause abdominal hypertension
- We recommend that fasciotomies are performed when signs and symptoms of compression persist after escharotomy, especially in high-voltage injury or very deep thermal burns
- We suggest that escharotomies and fasciotomies are performed by suitably experienced clinicians

Rationale

Circumferential burns can compromise torso compliance and extremities perfusion. It is of paramount importance that clinicians carefully look for them, as they require special monitoring and sometimes escharotomies or fasciotomies.

Elevation of the torso and affected limbs can reduce edema formation and, therefore, reduce complications.

Attention should focus on chest and abdominal movements, breathing, signs of abdominal hypertension and on skin color, capillary refilling, pulses, and pain or paresthesias in limbs.

In case of impairment of ventilation or circulation or abdominal compartment syndrome due to circumferential burns, the need of escharotomy should be evaluated and discussed with suitably experienced clinicians.

a) Escharotomies

Escharotomy involves full thickness incision of the circumferential burn down to the subcutaneous fat, reaching healthy tissue, in order to ensure full release, allowing reperfusion of the limb distally or chest/abdominal expansion (22).

No randomized controlled trials have addressed the treatment of extremities or truncal compartment syndromes, but the strength of recommendation is based on well-accepted clinical practice, expert opinion and several case series (23,24).

In most cases, escharotomies could be performed at the bedside, using electrocautery to minimize blood loss and, being painless, they often do not require anesthesia.

Escharotomy should be performed in the longitudinal axes of the affected part from normal skin to normal skin or in superficial burns. If not possible, it is preferable to surpass the incision to the next proximal joint (25). In order to release the tourniquet effect preserving at the same time the nerves and vessels, the incisions should be near their course, but not exactly over them.

Therefore, limb incisions are longitudinal and in the mid-axial lines (medial and lateral), except in hands and feet where incisions are on the dorsum. Trunk escharotomies might need to be enhanced by transverse incisions in the upper parts of the thorax and abdomen to allow expansion in all axes of both compartments.

b) Fasciotomies

Fasciotomy involves the incision of fascia, in order to achieve full release of deeper structures. Apart from high-voltage electrical injuries and very deep burns, fasciotomy is rarely indicated as a primary procedure in burns. Fasciotomy is indicated for compartment syndrome when the clinical and investigational picture of compression persists after escharotomy.

The strength of the recommendation is based on retrospective studies, expert opinion and clinical practice (23,24,26).

Fasciotomy is a more technically challenging procedure compared to escharotomy, as the risk of complications, especially injury of neurovascular bundles and deeper structures, is higher (26). Therefore, the decision to perform fasciotomies should be taken cautiously, especially in case of non-electrical burns. Moreover, it must be performed by experienced surgeons and, being painful, under general anesthesia. In addition, fasciotomies can cause the massive exposure of deeper structures, as muscles, with more demanding postoperative care and reconstructive phase.

Nevertheless, especially in cases of electrical burns, fasciotomies allow direct inspection of muscles for early necrotic tissues excision of the necrotic tissue, thus preventing acute renal failure, infection, and further limb loss (23). Therefore, there is no role for closed fasciotomies in burns; all the fasciotomies should be open, and it should be seriously considered in cases of high voltage electric burns.

Further research on the topic will have a substantial impact on practice decisions (23,24,27).

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BURN WOUND DRESSINGS

In this section, 3 main questions are asked:

1. How should the burn wound be cleaned and debrided?
2. How should the burn wound be dressed?
3. What are the main features of burn wound infection?

1. How should the burn wound be cleaned and debrided?

a) Wound cleaning

Recommendations

- We recommend that burn wounds are cleaned thoroughly before application of a suitable dressing
- We recommend that burn wounds are cleaned with normal saline or filtered tap water in the acute setting (i.e., <48 hours post injury)
- We recommend that burn wounds outside the acute setting are cleansed using an antiseptic solution which is effective against likely contaminant microorganisms, such as chlorhexidine or acetic acid

Rationale

Burn wounds should be cleaned to remove any debris or contamination and reduce the risk of infection or biofilm formation. A Cochrane review did not find any evidence that saline is superior to tap water for cleaning acute traumatic wounds, although the review did not specifically consider burn wounds (1). Hospital water supplies are commonly colonised with *Pseudomonas aeruginosa* (2), and for this reason, filtered tap water is preferable which can be achieved by point of use water filtration devices.

Although various antiseptics may be used to clean wounds, there is virtually no evidence for the use of such agents (3) in the acute setting. Antiseptics are of more use after the initial acute period when burn wounds are likely to be colonised with various microorganisms.

b) Wound debridement

Recommendations

- We recommend that burn wounds are debrided to remove any nonviable tissue and promote wound healing. Debridement can be done by physical, surgical or enzymatic means.
- We suggest that burn blisters are deroofed

Rationale

Burn wounds require debridement to remove necrotic or nonviable tissue from the wound bed. This may be done by applying dressings, by surgical debridement of eschar or by applying enzymatic debriding agents.

There is great debate about the most appropriate management of blisters in burn wounds (4). Arguments for deroofting include patient comfort, prevention of infection and burn wound deepening, assessment of the underlying wound, and allowing antimicrobial dressings to come into direct contact with the wound bed. Very small or adherent blisters, such as those on the palmar surface of the fingers, may be left intact or snipped open according to patient comfort.

Enzymatic debridement of burn wounds is gaining increasing popularity, although it is a relatively time-consuming technique with an associated learning curve. Debridement with a bromelain based enzyme has been described for deep partial thickness or full thickness burns including those to the hands and face. A multi centre randomised controlled trial showed reduced need for surgical excision and autografting compared to standard of care (5). Enzymatic debridement is a viable alternative to surgical excision in selected patients and should be considered where local expertise is available.

2. How should the burn wound be dressed?

Recommendations

- We recommend that burn wounds are covered with a suitable occlusive dressing until healed
- We suggest that antimicrobial dressings are considered for burn wounds at risk of colonisation and infection
- We suggest that temporary biosynthetic skin substitutes are considered for dressings where appropriate e.g., children with confluent superficial burn injuries
- We recommend that burn services regularly review the dressings they use as more dressings become available

Rationale

The ideal burn dressing maintains a moist wound healing environment, manages exudate, minimises biofilm formation or infection, is comfortable to apply, wear and remove and needs infrequent dressing changes. In addition, it is inexpensive, widely available and easy to store at room temperature. The vast number of studies comparing various types of burns dressings shows that at present the ideal dressing does not exist. It is beyond the scope of these guidelines to review all the available literature on burns dressings in order to make a recommendation. The choice of dressing should be an individual one based on patient and wound factors as well as local availability and physician preference.

There are a large number of dressings currently available, and many of these demonstrate antimicrobial activity, usually in the form of silver. A recent systemic review found that dressings containing nanocrystalline silver result in

shorter length of stay, reduced rate of surgery and infection and less pain than dressings containing silver in another form (6).

Whilst negative pressure wound therapy (NPWT) is sometimes used to secure skin grafts after surgical treatment of burns, there is insufficient evidence for a Cochrane review to make a recommendation about NPWT in the treatment of partial thickness burns (7).

Burn wounds may be dressed with temporary biosynthetic skin substitutes. These dressings may be used as definitive management of a superficial burn, or as a temporising measure prior to grafting after excision of a full thickness burn. They are frequently employed in children where pain relief and reduced need for frequent dressing changes (8) is offset against the need for application under general anaesthetic and associated morbidity (9).

3. What are the main features of burn wound infection?

Recommendations

- We recommend assessment of possible wound infection employing clinical assessment alongside qualitative or quantitative microbiological analysis
- We recommend that prophylactic antibiotics are not routinely given for acute burn injuries
- We suggest that antimicrobial dressings are used where appropriate to reduce the risk of burn wound infection

Rationale

Burn wound infection and sepsis are one of the leading causes of morbidity and mortality in burned patients. Features of infection/sepsis/SIRS may overlap with those of the hypermetabolic response associated with major burns which make diagnosis more difficult (10). Colonisation of burn wounds is widespread (11), and this must be distinguished from invasive infection to prevent the overuse of antibiotics.

In the smaller burn wound, signs of burn wound infection include increased pain, localised cellulitis and warmth, malodorous wound exudate and discolouration of the dressing. Patients may show systemic features of infection such as pyrexia, tachycardia, and hypotension. Colonisation may be demonstrated by qualitative or quantitative microbiological analysis. Positive results in combination with clinical features of infection should prompt consideration of antibiotic use alongside antimicrobial dressings and possibly surgical wound debridement or excision.

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MANAGEMENT OF BURN SHOCK

In this section, 5 main questions are asked:

1. What are the main concepts for burn shock management?
2. What is the optimal initial assessment of burn shock?
3. When are advanced hemodynamic measurements needed in burn shock?
4. Which therapeutic interventions should be used to improve perfusion in burn patients with shock?
5. When should a restrictive strategy for fluid administration be used?

1. What are the main concepts for burn shock management?

Recommendations

- We recommend that clinicians assess burn shock using a combination of mechanism and severity of burn injury and the patient's clinical response to initial resuscitation, having as basis the knowledge of burn shock physiopathology
- We suggest that standards for assessing and monitoring burn shock are based on the institutional expertise and the specific equipment of each burn centre
- We suggest that evaluation and monitoring of burn shock is guided by more than one single parameter
- We recommend that clinicians assess and treat burn shock targeting the therapeutic interventions to restoring tissue oxygenation and trying to avoid both under and over resuscitation

Rationale

Burn shock occurs in a major burn injury due to the disruption of normal homeostasis secondary to both local and systemic responses, including the release of cytokines and other inflammatory mediators (1).

The consequent circulatory failure is a unique combination of distributive and hypovolemic shock; the latest being characterised by intravascular volume depletion, increased systemic vascular resistance and impaired cardiac function. The final result is a failure to deliver and/or utilise adequate amounts of oxygen, leading to tissue dysoxia (2).

Burn shock characterised the first 24-72 hours after the initial damage (3), usually reaching its peak at 12-24 hours post-injury (4).

Circulatory failure occurring in burn patients after this period should be furtherly investigated and interpreted, since their physiopathology is different and they, therefore, need different therapeutic interventions (2).

No single specific score system exists to predict exactly the probability and the severity of burn shock, neither the accurate need for large volume fluid administration/replacement (3).

Nevertheless, the severity of burn injury represents an important screening tool to identify patients at risk of shock. Data from literature define a threshold of 15-20% total body surface area (TBSA) non-superficial (2nd and 3rd degree) burn injury as a "critical burn size" that

necessitates intravenous fluid resuscitation (5–7). Additionally, mechanism of injury, patient's physiology and response to initial resuscitation should guide the clinical management (5,6).

Clinical assessment and estimation of physiological parameters are valuable guides to assess the degree of hemodynamic insult after burn injury. To evaluate the hemodynamic status and to direct therapeutic interventions, recent consensus recommendations suggest performing a clinical examination of three organs readily accessible to the assessment of tissue perfusion: skin (examining the degree of cutaneous perfusion); kidneys (measuring urine output); brain (assessing mental status) (2,8). However, several limitations may hamper the use of these clinical criteria in burns. Skin perfusion suggesting an impaired microcirculation (acrocyanosis, mottled skin, slow capillary refill time and an increased central-to-peripheral temperature gradient) could be unrepresentative in patients with extensive burns or circular limb injury. In the same way, urine output could be abnormal in severe burns as a consequence of abdominal hypertension. Finally, mental status could be not easily assessable, as burn patients often require analgesia and sedation to manage pain or secure an adequate airway.

Consequently, therapeutic interventions in burn shock must be guided by further hemodynamic assessment (2). Considering the complexity of burn shock pathophysiology and presentation (1), more than one single parameter should be investigated and taken into account (2). Clinicians must use the monitoring equipment available at their centre, as they are familiar with its use and interpretation of the provided measurements.

Finally, it is essential to direct treatment to the key target of shock management (i.e. tissue perfusion) (2), avoiding normalising a single parameter, while losing the wider clinical framework. In fact, both over and under resuscitation have been proven to have serious detrimental consequences (9,10), and no single method or endpoint has been demonstrated superior to the others in guiding fluid resuscitation in severe burns (11).

2. What is the optimal initial assessment of burn shock?

a) Invasive arterial pressure monitoring

Recommendations

- We recommend arterial catheter insertion in cases of shock unresponsive to initial therapy and/or requiring vasopressor infusion and in patients with extensive burns on both arms
- We recommend to initially target a MAP of around 65mmHg in patients with no history of hypertension
- We recommend individualising the target blood pressure during shock resuscitation

Rationale

Indwelling arterial catheters allow continuous arterial blood pressure monitoring and regular blood gas analysis. Invasive pressure monitoring is particularly important in patients not responding to the initial therapy. Furthermore, limb burn injury hampers the use of noninvasive arterial pressure monitoring.

Arterial hypotension (defined as systolic blood pressure of <90 mmHg, or mean arterial pressure (MAP) of <65 mmHg, or a decrease of ≥ 40 mmHg from baseline) commonly occurs in patients with burn injury. However, the presence of low blood pressure should not be an essential point for defining shock, since compensatory mechanisms may preserve blood

pressure through vasoconstriction, while tissue perfusion and oxygenation are already impaired significantly (2).

There is evidence that a mean MAP of around 65 mmHg is sufficient in most patients with shock, although, in patients with a history of hypertension, a higher MAP is associated with a lower risk of acute kidney injury (2).

Consequently, blood pressure targets should be individualised.

b) Lactate levels, base deficit

Recommendations

- We suggest that serum lactate and/or base deficit measurements are used to estimate the extent of shock and to evaluate the effect of treatment
- We suggest that blood lactate levels > 2 mmol/L are considered an index of inadequate tissue perfusion

Rationale

The determination of lactate and/or base deficit may be particularly important in burn patients. Burn shock leads to the loss of the physiological independence between oxygen delivery and oxygen consumption resulting in tissue hypoperfusion and elevated lactate levels.

A significant correlation between lactate levels and severity of burn injury has been shown (12) and the prognostic value of lactate levels seems to be superior of that of blood pressure (2). In fact, lactate levels of 1.5-2 mmol/L in patients with circulatory shock appear to be associated with increased mortality (13,14).

Similar to the predictive value of lactate levels, the initial base deficit has been established as an independent predictor of mortality in patients with burn shock (15).

c) Urine output

Recommendations

- We suggest that urine output is integrated with other clinical parameters to guide fluid resuscitation, especially in situations with limited monitoring techniques availability

Rationale

Urine output has classically been adopted as the primary endpoint to guide resuscitation in burn care. Consensus recommendations suggest targeting a diuresis of greater than 0.5 mL / kg/h in adults and 1 mL/ kg/h in pediatric patients (5).

However, the value of urine output as a resuscitation endpoint in burn patients has been questioned (16), arguing that urine output is an inaccurate resuscitation target, contributing to the phenomenon of fluid overload.

Renal response to hypovolemia is multifactorial and depends on a combination of many factors, such as renal blood flow, renal perfusion pressure and oncotic plasma pressure. Additionally, the neurohormonal control of renal function and abdominal hypertension may further confound the clinical picture (17).

Controversy exists over the association of urine output monitoring and outcome. The use of alternative hemodynamic monitoring instead of hourly urine output seems associated with an increased survival with no effect on renal injury (11). However, when only randomised controlled trials were included in the analysis, no survival advantage of hemodynamic monitoring over hourly urine output for mortality was observed (11).

In conclusion, urine output may be considered a useful parameter to guide fluid resuscitation, particularly in resource-limited settings and limited monitoring techniques availability.

d) Central venous catheter: central venous pressure, central venous oxygen saturation

Recommendations

- We recommend to insert central venous catheter in case of shock unresponsive to initial therapy and/or requiring vasopressor infusion and when peripheral venous access is impossible
- We suggest against the use of central venous pressure for the estimation of preload and for guiding fluid resuscitation in severe burns
- We suggest that central venous oxygen saturation is measured in patients with an already inserted central venous catheter to help to assess tissue perfusion

Rationale

Insertion of central venous lines is necessary to deliver medications harmful for peripheral veins and when the peripheral venous access is poor or inaccessible.

Nevertheless, many studies have questioned the efficacy of central venous pressure as an endpoint for resuscitation. In fact, both in the general population of critically ill patients (17,18) and in the severe burns (16,19), central venous pressure does not correlate with ventricular filling pressures and ventricular end-diastolic volumes. Besides, in burn patients with increased intraabdominal pressure, an artificially increased central venous pressure has been observed (19). In conclusion, central venous pressure should not be used to guide resuscitation in burn shock.

Central venous oxygen saturation (ScvO₂), measured in blood samples from superior vena cava, can be used as an index of tissue oxygenation, as an alternative of mixed venous oxygen saturation (SvO₂) (2,11,20). However, the value of ScvO₂ as a target for fluid resuscitation has been questioned (21,22), and some limitations in its interpretation have been highlighted (2,23). Moreover, measurement of ScvO₂ requires the insertion of a central venous catheter in the superior vena cava via the jugular or the subclavian vein (24), which are not always accessible in severe burns. In conclusion, clinicians must interpret ScvO₂ in combination with other endpoints.

3. When and how should additional hemodynamic measurements be used in burn shock?

Recommendations

- We suggest that additional hemodynamic measurements are used only in severe burns not responding to initial therapy or in complex situations (e.g. coexistent trauma, preexistent comorbidities)
- We suggest using dynamic parameters for guiding fluid resuscitation when additional hemodynamic measurements are needed

- We suggest against the use of static parameters for estimation of preload to predict fluid responsiveness
- We suggest that the choice of the monitoring method is based on institutional expertise and patient's specificities

Rationale

a) Indication and interpretation of additional hemodynamic measurements

Additional hemodynamic measurements may help clinicians to guide therapeutic interventions in burn shock, evaluating cardiac function, preload and fluid responsiveness.

In complex situations, such as in patients with major burn injuries, in patients with coexistent trauma (fractures, trauma of visceral organs, spinal cord injury) and or pre existent comorbidities, such techniques may help to understand the hemodynamic disturbances and identify the factors on which treatment should be focused.

Nevertheless, clinicians should target the therapeutic interventions to the key goal of shock management (i.e. tissue perfusion) (2), avoiding normalising a single parameter, while losing the wider clinical framework.

In fact, no single method or endpoint has been demonstrated superior to the others in guiding fluid resuscitation in severe burns (11).

b) Dynamic hemodynamic parameters for assessing fluid responsiveness

Dynamic parameters (including assessment of pulse pressure variation (PPV) and stroke volume variation (SVV) via arterial pulse contour analysis or non-invasively by plethysmography, as well as the measurement of vena cava collapsibility using echocardiography) seem to be highly predictive of fluid responsiveness in mechanically ventilated burn patients (25). However, it must be emphasised that dynamic parameters (PPV and SVV) do have several limitations. In particular, PPV and SVV are unreliable in patients with spontaneous breathing activity, cardiac arrhythmias, pericarditis, cardiac tamponade, right ventricular failure, high PEEP or high intraabdominal pressure and low tidal volume ventilation (2,17).

Another method of increasing popularity is the passive leg raise (PLR) test, where a reversible increase of preload is caused by simply raising the patient's legs to mimic the effects of a fluid challenge (16). An increase in the cardiac index or stroke volume of 10% during a PLR test is a predictor of fluid responsiveness. A 10% increase in pulse pressure on an arterial line tracing is a commonly used surrogate measure for stroke volume. Besides the ease and economic advantage, this test is completely reversible, whereas a fluid challenge could worsen resuscitation related morbidity (31). In contrast to predicting fluid responsiveness with PPV and SVV, the PLR test is reliable in patients with arrhythmias and spontaneous breathing activity. However, one must be cautious because the PLR can provide false negative results in patients with elevated IAP, where the venous return is impaired (2,16). Additionally, this method has limited value in patients with burn injury affecting lower limbs, especially those with deep circular wounds.

c) Static hemodynamic parameters for assessing fluid responsiveness

While fluid resuscitation should not be delayed in burn shock, efforts should be made to assess if a patient will respond to fluids. Ideally, in cases of shock, a clinician should be able to use a measure of preload to determine whether a patient requires additional fluids to increase

cardiac output (CO). Determination of filling pressures, measured invasively by central venous catheter (central venous pressure, CVP) or pulmonary artery catheter (pulmonary artery catheter occlusion pressure, (PAOP) are the most commonly used indices of right ventricular (RV) and LV preloads, respectively. Volumetric parameters assessed by transpulmonary thermodilution and end-diastolic ventricular volumes determined by echocardiography are also used to evaluate preload (2). However, each of these pressure and volume measurements has their limitations. Poor correlations between estimates of preload (whether pressures or volumes) and predictions of fluid responsiveness have been widely reported.

Recent studies (16,17) have questioned the efficacy of CVP and PAOP as endpoints for resuscitation as these parameters do not correlate with ventricular filling pressures and ventricular end-diastolic volumes. In addition, in burn patients with increased intraabdominal pressure, the artificially increased CVP or PAOP levels could be observed.

d) Volumetric parameters for preload assessment

Transpulmonary thermodilution technique allows the monitoring of preload using static volumetric indices such as global end-diastolic volume (GEDV) and intrathoracic blood volume (ITBV). Volumetric preload indicators seem to be superior when compared to barometric ones and are recommended to guide fluid resuscitation, especially in patients with increased intraabdominal pressure (16).

Another parameter that can be derived from transpulmonary thermodilution is the extravascular lung water (EVLW) which estimated the interstitial, intracellular and intra-alveolar water of lung tissue. Evaluation of EVLW, together with the pulmonary vascular permeability index (PVPI), can be used to determine the presence of lung oedema providing early signs of the risks associated with fluid overload (2,32,33).

e) Techniques for additional hemodynamic measurements

A brief description of the different techniques and methods available for evaluating cardiovascular performance, preload and fluid responsiveness is provided below.

However, clinicians must use the monitoring equipment available at their centre, as they are familiar with its use and the interpretation of the provided measurements.

Echocardiography

Echocardiography allows rapid characterisation of shock and is now proposed as one of the first-line evaluation modalities (26). Although the use of echocardiography is already well consolidated, training of burn specialists in this technique remains challenging. Additionally, this method does not allow measuring various hemodynamic variables continuously and may not provide the real-time data needed for optimal acute management of unstable patients. The advantages of echocardiography in the setting of shock are its noninvasiveness and easy to apply character. Hemodynamic indices obtained from the echocardiographic evaluation can predict outcome in trauma and burn patients (27). The increasingly popular transthoracic echocardiography (TTE) method of CO measurement seems to be as accurate as the widely used transpulmonary thermodilution (TPTD) method. Wurzer et al (28) recently reported that transthoracic echocardiography -derived estimates of CO may underestimate the severity of the hyperdynamic state in severely burned children. The use of transesophageal echocardiography in burn units is limited due to the invasiveness of this technique and requirement for specific training. The authors of the recently published study reported the use of transesophageal echocardiography (TEE) performed by burn specialists during the early

post-burn resuscitation and concluded that this technique can be successfully and accurately carried out by burn specialists for cardiac function and volume status assessment when transthoracic echo windows are limited (29). Competency in basic critical care echocardiography is now regarded as a mandatory part of critical care training with clear evidence available. However, repeated echocardiographic evaluations are not always feasible in burn unit setting; thus, if available, a combination of echocardiography with other technologies is warranted. The role of echocardiography in optimising routine burn resuscitations needs to be further studied.

Transpulmonary indicator dilution techniques

These techniques systems allow cardiac output to be investigated less invasively, using central venous (to allow calibration) and arterial catheters. Cardiac output values measured using transpulmonary or ultrasound indicator dilution techniques correlate well with those measured using pulmonary artery catheter thermodilution (30). Less invasive techniques of hemodynamic monitoring allow beat-to-beat cardiac output monitoring, permit assessment of fluid responsiveness by measurement of variations of stroke volume and pulse pressure, provide volumetric variables such as global end-diastolic volume, and measure extravascular lung water and pulmonary vascular permeability.

Pulmonary artery catheter

The intermittent and continuous cardiac output calculation technique using a pulmonary artery catheter is widely considered as the standard method

of reference in hemodynamic monitoring. The pulmonary artery catheter has an advantage over other systems as it provides at same time measurements of other useful hemodynamic parameters in addition to cardiac output including pulmonary artery pressure measurement and SvO₂. However, the benefit of the use of pulmonary artery catheter has been controversial due to its invasiveness and unproven clinical utility.

4. Which therapeutic interventions should we use to improve perfusion in burn patients with shock?

a) Fluids

Recommendations

- We recommend starting fluid resuscitation in adult patients with burns greater than 20% total burn surface area (TBSA) and in pediatric patients with burns greater than 10% TBSA
- We recommend prescribing 2 to 4 ml/kg/% TBSA during the first 24 hours
- We recommend using crystalloid solutions as first line
- We recommend against the use of normal (0.9 %) saline
- We suggest against the systematic use of colloids (especially synthetic); however, it can be considered as salvage therapy
- We suggest fluid de-escalation after the first 24 hours

Rationale

Fluid creep phenomenon

Under- and over-resuscitation have been associated with complications and poor outcome in patients with burns (17). In order to maintain tissue oxygenation, traditional treatment of

burn patients includes early and aggressive fluid administration to restore and maintain intravascular volume. This approach may, however, lead to the increase of the intravascular hydrostatic pressure with some negative consequences. Last decades there has been increasingly recognised concern about fluid overload phenomenon which was referred to as a “fluid creep” by Pruitt (10,34). The main clinical manifestations of this phenomenon are the development of abdominal compartment syndrome, excessive burn oedema and deterioration of burn wound condition, respiratory failure, acute kidney injury, hypothermia, coagulopathy and multiorgan failure.

There is an ongoing debate on fluid resuscitation in severe burn injury, especially for the first 24 hours after trauma. According to the recent ISBI consensus recommendations, adult patients with burns greater than 20% total burn surface area (TBSA), and pediatric patients with burns greater than 10% TBSA should be formally resuscitated with salt-containing fluids; fluid requirements should be based on percentage of burn injury and body weight (5). The commonly used Parkland (4 ml·kg⁻¹ crystalloids per percent TBSA (%TBSA) burned) and modified Brooke (2 ml·kg⁻¹ per %TBSA) formulas using crystalloids, as lactated Ringer’s solution, remains a mainstay of initial fluid therapy. Half of the total dose of crystalloids and colloids should be given in the first eight hours and the other half in the next 16 hours. Resuscitation rate should be gradually decreased when the hemodynamic and urine output endpoints are reached. De-resuscitation (a gradual decrease in resuscitation fluids) has been shown to be associated with improved outcome (17,35,36).

Type of fluids

There are still conflicting opinions about the use of normal saline and colloids during the initial fluid resuscitation strategy to support circulation in burn patients. Evidence supports the superiority of balanced crystalloids over normal saline during fluid resuscitation (36). Normal saline contains supraphysiologic concentrations of sodium and chloride, and the use of normal saline is associated with the development of hypernatremia, hyperchloremic metabolic acidosis and the increased risk of acute kidney injury.

There are still conflicting opinions about use of colloids as the initial strategy to support circulation in critically ill patients. The increasingly recognised concern about fluid overload has renewed interest in alternative solutions when a large amount of fluids are required. The addition of colloids as adjuncts may constitute a reasonable approach in preventing of a phenomenon of over-resuscitation in burns (37). The addition of colloid to Parkland resuscitation seems to reduce fluid requirements, restore normal resuscitation ratios, and prevent the phenomenon of “fluid creep” (38). Successful resuscitation with the use of colloids as a part of specific pediatric resuscitation protocol is reported by Faraklas et al (39).

A recently published meta-analysis (40) aimed to determine the effect of burn shock resuscitation with albumin on mortality and morbidity in adult burn patients suggests that albumin can improve outcomes of burn shock resuscitation. The use of albumin was associated with decreased occurrence of compartment syndrome and reduced mortality. However, the authors of this review highlight that the quality of current evidence regarding this topic are limited, and additional trials are needed to confirm the positive impact of albumin resuscitation. The effect of albumin infusion on mortality during the initial fluid resuscitation evaluated in a recent systematic review and meta-analysis of randomised controlled trials (41). The results of this study showed that total volume of fluid infusion during the phase of resuscitation was lower in patients receiving albumin containing solution; however there was no significant effect on the mortality rate in burn patients resuscitated with albumin solutions.

There are still conflicting opinions about use of colloids as the initial strategy to support circulation in burn patients. Recent publications question clinical benefit associated with the use of colloids compared to crystalloids in light of its expense, negative impact on renal function and lack of proven outcome improvement (36,42)[.

There are limited data on the efficacy of early fluid resuscitation with synthetic colloids in burn injury. Béchir et al. in a randomised, controlled, double-blind clinical trial (43) compare infusion of Ringer's lactate solution plus 6% HES 130/0.4 in a ratio of 2:1 or lactated Ringer's solution with no colloid. This study found no difference in amount of administered total fluid from intensive care unit during the first 72 hours after burn injury. Although the commonly described outcome parameters negatively affected by the use of colloids (such as renal function, incidence of ARDS, length of stay and mortality) were not negatively influenced by the use of colloids in this study, the addition of balanced HES to lactated Ringer's solution was not considered superior to lactated Ringer's solution alone.

Synthetic colloids (HES, gelatins) have not shown superiority over crystalloids, and their safety is uncertain. The use of fresh frozen plasma for volume expansion is associated with high cost and risk of infectious disease transmission (44).

Quality of current evidence on this issue is limited, and new adequately powered, randomised multicenter clinical trials should be conducted on the use of colloids during early resuscitation in burn patients.

b) Vasopressors and inotropic agents

Recommendations

- We recommend administration of vasopressors in the presence of life threatening hypotension despite adequate fluid resuscitation, basing the decision on an accurate hemodynamic evaluation
- We recommend adding inotropic agent in the presence of persisting signs of tissue hypoperfusion under adequate fluid resuscitation and vasopressors

Rationale

Evaluation of cardiac function is crucial when deciding on whether inotropic agents should be included in the therapy of the patients. Vasopressors may be required transiently to sustain arterial pressure and maintain tissue perfusion in the presence of life-threatening hypotension, especially when fluid expansion is in progress and hypovolemia has not yet been corrected (2). An assessment of cardiac function, preload and afterload is essential when deciding to start vasopressors. The presence of myocardial dysfunction requires adding an inotropic agent such as dobutamine or epinephrine. Studies that investigated the use of norepinephrine (NE) in hemorrhagic shock have suggested that NE infusion reduces the amount of fluid resuscitation required to achieve a given arterial pressure target and is associated with significantly improved survival in animal models (45,46). However, the effects of NE have not been rigorously investigated during burn shock resuscitation.

5. When should a restrictive strategy for fluid administration be used?

Recommendations

- We recommend that fluid management is titrated carefully and/or de-escalated, especially in the presence of elevated intravascular filling pressures or extravascular lung water

Rationale

For decades, the perpetual paradigm in the management of the critically ill burn patients has been to ensure patients are not fluid deficient, with no attention paid to the problems related to fluid overload. Several studies published in the last few years demonstrated that aggressive fluid resuscitation, often initiated in the pre-hospital setting, may be detrimental for burn patients (47,48).

In the study of Arlati et al. (48) the authors evaluate the impact of restricted fluid volume administration (permissive hypovolemic approach) on multiple-organ dysfunction after severe burns in a prospective study and found that permissive hypovolemia and conservative fluid administration seems safe and effective in reducing multiple-organ dysfunction in burn patients. Permissive hypovolemia allowed for less volume infusion, a reduced positive fluid balance and significantly lower multiple organ dysfunction (MODS) score values than the Parkland Formula.

Another recent study that supports a restrictive volume replacement strategy was reported by Sánchez et al. (32). In this three-year prospective cohort study of 132 consecutive patients with severe burn injury, an adequate tissue perfusion was achieved with below-normal levels of preload. The authors concluded that early resuscitation guided by lactate levels and below-normal preload volume targets appears safe and avoids unnecessary fluid input. Results from these studies suggest that excessive fluid administration might be harmful to patients, but the interpretation of these data is hampered by substantial methodological heterogeneity of the studies and the small number of patients included.

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Appendix A

The critical appraisal of previous released international burn care guidelines was realised by a multidisciplinary working group based in Turin (Italy), under the supervision of methodological advisers. Their work provided the basis for the further recommendations' development, identifying the synthesis of the current evidence in the field of burn care.

No members of the working group reported any conflicts of interest.

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