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RECENT BURN CURE MANAGEMENT STUDIES

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ABSTRACT

A good number of research articles published on recent developments in burn cure management were studied. 122 research articles based on quantitative as well as qualitative research methods were included, resulting in a comprehensive overview of existing published research. The aim of the present study is to analyze the recent developments in burn cure management and changes of cure rate and the main causes of death in the last 40 years. The cure rate increased significantly in the recent years, and the main causes of death changed from shock and sepsis in the time period 1959–1978 to sepsis and MODS in the past two decades. Due to the improvement of early comprehensive management of burn shock, aggressive surgical approach to burn wound and potent systemic supporting measures, the survival rate increased significantly.

INTRODUCTION

The World Health Organization (WHO) showed in 2004 that over 90% of the total fatal fire-related burns occur in developing or low income countries (LIC).1 In LIC the rate of death and disability from injuries (including burns) is increasing. As a global concern, preventing fires (i.e. smoke detectors), responding to fires (i.e. fire department personnel) as well as individual consequences (i.e. healthcare costs) all combine to create economic burden. This burden is greatest among poorer countries that have incomplete regulation to prevent fires, limited access to emergency responders and few options for insurance and disability coverage. In comparison, in the United States between the years 2001 and 2010 there was a 96% survival rate of all patients admitted to one of the 125 burn center's. Seventy-five percent of deaths related to fire and burn injuries occurred at the scene or during initial transport. Preventing the 75% out-of-hospital deaths are as important as assuring the remaining 25% get appropriate medical attention. In high income countries (HIC) the incidence of injuries as well as morbidity and mortality from burns is decreasing. The improvement is attributed to increasing prevention as well as improving medical therapy. Optimization of burn care in low income settings is a priority. Development of an effective national burn care model is dependent on money, materials and knowledge. For the individual patient, treatment should begin with adequate first aid to limit tissue damage, morbidity and need for surgery. In many parts of Africa, homemade remedies such as urine and mud, cow dung, beaten eggs or mud and leaves are the primary treatments. Combining traditional and western knowledge at the lay-person level may be the first step in developing a burn care model.

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Fire-related burns are one of the major causes of disability adjusted life years (loss of the equivalent of one year of good health) in low income countries. Because of the large burden on society there is significant interest, such as in the World Burn Foundation, in returning survivors to their baseline level of function. Burns have physical and psychological effects on survivors and require comprehensive rehabilitation. Even in HIC there is a 90% dropout rate in the first year for those who do attempt rehabilitation. Despite national professional societies such as, South Africa Burn Society, Trauma Society of South Africa, National Burn Association of South Africa and social support societies such as Child safe, Southern Africa. Burn Foundation, and Children of Fire, much work is yet to be done to improve patient outcomes.[1]

METHODS

Red blood cell transfusion following burn:

A severe burn will significantly alter haematologic parameters, and manifest as anaemia, Current transfusion protocols use a specific level of haemoglobin or haematocrit, which dictates when to transfuse packed red blood cells (PRBCs). This level is known as the trigger. There is no one 'common trigger' as values range from 6 g dl−1 to 8 g dl−1 of haemoglobin. This was to analyze the current status of red blood cell (RBC) transfusions in the treatment of burn patients, and address new information regarding burn and blood transfusion management. All RBC transfusions should be tailored to the patient's blood volume status, acuity of blood loss

and ongoing perfusion requirements. The study focus on the prevention of unnecessary transfusion as well as techniques to minimize blood loss, optimize red cell production and determine when transfusion is appropriate.[2]

Diagnostic biomarkers for acute kidney injury in major burn patients:

The study was to evaluate accuracy and reliability of the biomarkers for the diagnosis of AKI and for the early prediction of the development of AKI in major burn patients. The mortality associated with AKI remains exceedingly high in these patients despite advances of critical care and renal replacement therapy (RRT). Recently, several favorable biomarker candidates such as urinary kidney injury molecule-1, neutrophil gelatinase-associated lipocalin, interleukin-18, cystatin C, clusterin, fatty acid binding protein-liver type.[3]

Hydrogen as a new therapeutic agent:

Recent evidence has shown that hydrogen is a potent antioxidative, antiapoptotic and anti-inflammatory agent and so may have potential medical applications in cells, tissues and organs. There are several methods to administer hydrogen, such as inhalation of hydrogen gas, aerosol inhalation of a hydrogen-rich solution, drinking hydrogen dissolved in water, injecting hydrogen-rich saline (HRS) and taking a hydrogen bath[4]

Third degree formic acid chemical burn in the treatment of a hand wart:

Cutaneous warts are very common and a large variety of topical treatments and drugs can be employed to cure these skin injuries that can arise on any part of the body. This is the first report of a chemical burn by formic acid in the treatment of warts. Only a few treatments have proven their effectiveness, such as salicylic acid or cryotherapy with liquid nitrogen that are commonly used. Moreover, most cutaneous warts will resolve spontaneously without any treatment and several products, including topical acids and cryotherapy devices, presented adverse effects such as chemical burns or frostbites so demonstrating that even frequently used treatments can be harmful. [5]

Fluid resuscitation in severe thermal burn adult patients:

In the present study, a dynamic urine output based infusion rate prediction model was developed and validated during the initial 48 hours in severe thermal burn adult patients. The experimental result demonstrated that the developed dynamic fluid resuscitation model might significantly reduce the total fluid volume by accurately predicting hourly urine output and has the potential to aid fluid administration in severe burn patients. [6]

Skin substitutes from human skin cells and biomimetic nanofibers for acute full-thickness wound repair:

The study was to investigate the possibility of fabricating skin substitutes via a bottom-up nanofiber-enabled cell assembly approach and using such substitutes for full-thickness wound repair in nude mice. Following a layer-by-layer (L-b-L) manner, human primary skin cells (fibroblasts and keratinocytes) were rapidly assembled together with electrospunpolycaprolactone (PCL)/collagen (3:1, w/w; 8%, w/v) nanofibers into 3D constructs, in which fibroblasts and keratinocytes were located in the bottom and upper portion. Biomimetic nanofibers and they are effective to heal acute full-thickness wounds in nude mice.[7]

Skin graft fixation in severe burns: use of topical negative pressure:

The application of topical negative pressure (TNP) therapy devices has demonstrated improved graft take in comparison to conventional dressing methods alone. The study was to analyze the impact of TNP therapy on skin graft fixation in large burns. After a burn depth adapted wound debridement, coverage was simultaneously performed using split-thickness skin grafts, which were fixed with staples and covered with fatty gauzes and TNP foam. They consider that split thickness skin graft fixation by TNP is an efficient method in major burns, notably in areas with irregular wound surfaces or subject to movement (e.g. joint proximity), and is worth considering for the treatment of aged patients.[8]

Prevention of autologous skin graft loss:

Autologous skin graft is still the sole solution for 3rd degree burn management. Burn surgeon should be aware that skin donor site is somehow deliberately created wound which is equal to split thickness burn site. When donor site is limited as in the case of severe burns, skin graft loss at the donor site is embarrassing event. While thick skin graft looks more advantageous than thin ones according to literature, however burn surgeons have traditionally been trying to harvest autologous skin grafts as thin as possible. [9]

Hemostasis in burn surgery:

Over the past 30 years, techniques of early excision and grafting along with enhancement of critical care

have significantly improved survival following burn injury. Despite these advancements, large volume blood loss associated with surgical intervention continues to be a challenging aspect of burn surgery. This review article will examine the methods of limiting blood loss during surgical procedures[10]

Infection control in the burn unit:

The nature and extent of the thermal injury influencing infections, the type and quantity of microorganisms that colonize the burn wound appear to influence the future risk of invasive wound infection. The value of infection prevention has been acknowledged in organized burn care since its establishment and is of crucial importance. It focuses on modern aspects of the epidemiology, diagnosis, management, and prevention of burn wound infections and sepsis.[11]

Silver compounds are increasingly used in medical applications and consumer products. Confusion exists over the benefits and hazards associated with silver compounds. In this article, the biochemistry and physiology of silver are reviewed with emphasis on the use of silver for wound care. [12]

Development and evaluation of a novel smart device-based application for burn assessment and management:

Novel software application that provides a simple and interactive Lund–Browder diagram for automatic calculation of total body surface area (TBSA) burned, fluid formula recommendations, and serial wound photography on a smart device platform. The software was developed for the iPad (Apple, Cupertino, CA) smart device platforms. Ten burns ranging from 5 to 95% TBSA were computer generated on a patient care simulator using Adobe Photoshop CS6 (Adobe, San Jose, CA).Developed an innovative smart device application that enables accurate and rapid burn size assessment to be cost-effective and widely accessible.[13]

Radiation burn from mechanism to management:

Skin has a specific tolerance to radiation, above which different grades of radiation burn can occur. Being a rare and less studied problem, no precise guideline is present for its management. Because of few unresolved issues in the pathophysiology of deep radiation burn, its management is difficult. [14]

Treatment of hypertrophic burn scarring with the pulsed dye laser:

The use of Pulsed Dye Laser (PDL) as a therapeutic tool for hypertrophic burns scarring. The efficacy of PDL for both prevention and treatment is summarized for all hypertrophic scarring and the various laser treatment protocols in previous research is studied. The differentiation between prevention and treatment is discussed in relation to scar duration and the need for prevention rather than treatment is then proposed for intervention using PDL. [15]

Extracorporeal blood purification in burns:

A prolonged and fulminate inflammatory state, with high levels of pro- and anti-inflammatory mediators, is seen after extensive thermal injury. Blood purification techniques including plasma exchange, continuous venovenous hemofiltration, and adsorbing membranes have the potential to modulate this response, thereby improving outcomes. It describes the scientific rationale behind blood purification in burns and regarding its potential application in this patient cohort.[16]

Transesophageal echocardiography in the management of burn patients:

The major pathologic findings in burn patients were reduced left ventricular (LV) systolic and diastolic function, mitral valve vegetation, pulmonary hypertension, pericardial effusion, fluid overload, and right heart failure. TEE serves multiple diagnostic purposes and is being used to better understand the fluid status and cardiac physiology of the critically ill burn patient. Randomized controlled trials especially on fluid resuscitation and cardiac performance in acute burns are warranted to potentially further improve outcome.[17]

Vitamin d status after a high dose of cholecalciferol in healthy and burn subjects:

Burn patients are at risk of vitamin D (VD) deficiency and may benefit from its pleiotropic effects as soon as acute phase. The study was to assess effects of a cholecalciferol (VD3) bolus on VD status in adult burn patients (Group B, GB) after admission, compared to healthy subjects (Group H, GH). This study highlighted the differences in VD status and in response to a high dose VD3 in burn patients when compared to healthy patients. [18]

Increased wound ph as an indicator of local wound infection in second degree burns:

It is known that the pH of the skin surface of healthy adults and children is 4.2–5.6 and that it decreases with the lapse of epithelialization. The causative organisms were Staphylococcus aureus in 2 cases and Staphylococcus epidermidis .. In cases of local infection, the pH rose prior to the onset of clinical signs of local burn infection. By consecutive

measurement of pH, early detection of local wound infection can be achieved and this is very beneficial in clinical practice. In conclusion, consecutive pH measurement of exudates is considered to be a useful indicator in the treatment of second degree burns.[19]

Phylogenetic study of metallo-β-lactamase producing multidrug resistant pseudomonas aeruginosa isolates from burn patients:

The study was carried out to understand the clonal relationship using enterobacteriaceae repetitive intergenic consensus polymerase chain reaction (ERIC-PCR) among metallo-β-lactamase (MBL) producing multidrug resistantPseudomonasaeruginosa isolates from burn victims and their susceptibility to commonly used anti-pseudomonal agents.[20]

Burn is still one of the most devastating injuries in emergency medicine while improvements in wound healing knowledge and technology have resulted into development of new dressings. This study was undertaken to evaluate the healing effect of licorice in Pseudomonas aeruginosa infected burn wounds of experimental rat model.[21]

The influence of various microclimate conditions on the burn wound:

Microclimate factors, such as temperature, humidity, pH, gas composition and pressure, have a significant influence on the evaporative water loss through the burn wound, local infection, healing process and skin graft take. The accumulated data regarding the influence of various combinations of microclimate conditions on the burn wound is controversial, and is evidenced by contradictory approaches to the local treatment.[22]

A measure of the extent of burn injury based on fluid resuscitation:

The classic method of assessing burn size—the estimation of the percentage body surface area burned—provides a systematic error peculiar to each observer so that it is not possible to compare results from one burn treatment centre to another. Analyses of the data showed that net fluid retention is an accurate measure of the extent of burn injury, and approximately equivalent to the percentage body surface area burned when the estimates of percentage burn are made by a small, consistent clinical team in a single burn care system.[23]

Interventions for treating phosphorus burns:

The two comparative studies provide no evidence to support the use of copper sulphate in managing phosphorus burns. Indeed the small amount of available evidence suggests that it may be harmful. First aid for phosphorus burns involves the common sense measures of acting promptly to remove the patient's clothes, irrigating the wound(s) with water or saline continuously, and removing phosphorus particles.[24]

The use of telemedicine in burn care: development of a mobile system for tbsa documentation and remote assessment:

BurnCase 3D was initiated in order to develop a tool for objective burn assessment and documentation on mobile devices (Apple iPhoneTM). The centerpiece is a 3D model representing the actual patient. The burns were transferred to the model and the TBSA in % was calculated by the software BurnCase 3D. The preferred methods of the 80 respondents for burn extent estimation were: the Rule of Nines (38%), the Rule of Palm (37%) and the Lund-Browder chart (18%). In the acute care setting for burn injuries, telemedicine has great potential to help guide decisions regarding triage and transfer based on TBSA, burn depth, patient age and injury mechanism.[25]

Effects of dynamic action of hot spring water as a rehabilitative treatment for burn patients in Switzerland:

The therapy uses specific mineral enriched hot spring water and water jets with varied hydro-pressure to combat hypertrophy, inflammatory reaction signs, abnormal pigmentation, and, more specifically, redness and scarring. Patients showed lasting effects from this regimen (up to 3-6 months), the results becoming permanent with more uniform skin structure, color and visco-elasticity in addition to a decrease in pruritus. The specifications of clinical protocols are described herein along with the virtues of hot spring hydro-pressure therapy for burn rehabilitation. The use of hydrotherapy, which has been a controversial topic among burn units across the world, is also discussed. [26]

Enteral nutrition support in burn care:

Failure to adequately address the increased levels of inflammatory mediators, catecholamines and corticosteroids central to the hypermetabolic response post burn injury can lead to catastrophic results. The provision of the right balance of macro and micronutrients, along with additional antioxidants is essential to mitigating the hypermetabolic and hypercatabolic state that results following a burn injury. Recently fat to carbohydrate

ratios, glutamine and antioxidants have made up the balance of this focus.[27]

Hypertrophic burn scar evolution and management:

The burn injury is characterized by unique differences in the nature of tissue trauma, the pathophysiologic response to that trauma and the molecular events that impact on the evolution of scar formation in these injuries. Some nuances in the burn injury profile have direct influence on scar outcome but have not been concentrated on in the past when designing treatment regimens for scar control. These include the exposed nerve endings, stimulation of neuropeptide mediators, neurogenic inflammation, pruritis, mechanotension signaling and hydration. A composite device for scar control in burn injuries should involve a multimodal approach that incorporates strategies for control of these contributing factors. A protective, hydrative, tension relieving device is predominant among the requirements, with substance impregnation being a secondary possibility in future renditions.[28]

Burning mouth syndrome:

Burning mouth syndrome is an enigmatic condition because the intensity of symptoms rarely corresponds to the clinical signs of the disease. It is a burning or stinging sensation affecting the oral mucosa, lips and/or tongue in absence of clinically visible mucosal lesions. There is strong female predilection. Affected patients often present with multiple oral symptoms including burning, dry mouth, pain & taste alterations. The etiology is multifactorial & remains poorly understood. Burning mouth syndrome is a challenge to diagnose and manage. The present article discusses some of the recent understanding of etiopathogenesis of BMS as well as the role of pharmacotherapeutic management in this disorder[29].

Ectopic expression of human acidic fibroblast growth factor 1 in the medicinal plant, salvia miltiorrhiza, accelerates the healing of burn wounds:

Human acidic fibroblast growth factor 1 (FGF-1) plays an important role in a variety of biological processes, including angiogenesis, and tissue repair. Salvia miltiorrhiza is widely used in traditional Chinese medicine as an herb for the treatment of various diseases, including cardiovascular and cerebrovascular diseases, and traumatic injuries. They present that expression of FGF-1 in S. miltiorrhiza significantly accelerates the healing of burn wounds. The product appears to retain the biological activity of both FGF-1 as well as the medicinal properties of the plant. The extracts from transgenic S. miltiorrhiza combines the therapeutic functions of FGF-1 and the medicinal plant, S. miltiorrhiza. Topical application of the product can reduce the costs associated with extraction, purification, and recovery.[30]

The study was to determine whether urine ubiquitin levels are elevated after burns and to assess whether urine ubiquitin could be useful as a noninvasive biomarker for burn patients. Ubiquitin urine levels are significantly increased after burns. Renal ubiquitin excretion and/or excretion rates are associated with %TBSA, sepsis/multiple organ failure, and mortality. Although these findings may explain previous correlations between systemic ubiquitin levels and outcomes after burns, the large variability of ubiquitin urine levels suggests that urine ubiquitin will not be useful as a noninvasive disease biomarker.[31]

Active dynamic thermography is a sensitive method for distinguishing burn wound conversion:

Burn conversion is a contributor to morbidity that currently has no quantitative measurement system. Active dynamic thermography (ADT) has recently been characterized for the early assessment of burn wounds and resolves the three-dimensional structure of materials by heat transfer analysis. As conversion is a product of physiological changes in three-dimensional structure, with subsequent modification of heat transfer properties, the authors hypothesize that ADT can specifically identify the process of burn conversion and serve as an important tool for burn care. This study has demonstrated that ADT can directly identify burn wound conversion, while LDI can identify non converting wounds. Further advancement of ADT technology has the potential to guide real-time interventional techniques.[32]

Whole blood neutrophil gelatinase-associated lipocalin predicts acute kidney injury in burn patients:

Early detection of acute kidney injury (AKI) in severely burn-injured patients can help alter treatment to prevent progression to acute failure and reduce the need for renal replacement therapy. We hypothesized that whole blood neutrophil gelatinase-associated lipocalin (NGAL) will be increased in severely burn-injured patients who develop AKI during acute resuscitation.[33]

Colloid solutions for the treatment of burns:

Colloid solutions are widely used for fluid resuscitation including children, although there is an ongoing controversy concerning their actual use in children.. From the available evidence it appears that colloid solutions do not have a proven benefit compared to crystalloid solutions. Because colloids are more expensive and more likely to cause adverse effects an inclusion may not be recommended. The objective of this review is to examine the available scientific evidence for use of Colloids in childrento enable informed decision whether colloids should be. The review will focus primarily on trauma and burns as indications for the use of colloids in children.[34]

Feasibility of articulated arm mounted oculus rift virtual reality goggles for adjunctive pain control during occupational therapy in pediatric burn patients:

The study provides the first evidence that entering an immersive virtual environment using very inexpensive (~$400) wide field of view Oculus Rift Virtual Reality (VR) goggles can elicit a strong illusion of presence and reduce pain during VR. Although case studies are scientifically inconclusive by nature, these preliminary results suggest that the Oculus Rift VR goggles merit more attention as a potential treatment for acute procedural pain of burn patients. Availability of inexpensive but highly immersive VR goggles would significantly improve cost effectiveness and increase dissemination of VR pain distraction, making VR available to many more patients, potentially even at home, for pain control as well as a wide range of other VR therapy applications.[35]

Fetal bovine dermal scaffold (primatrix) in the management of full-thickness handburns:

Management of full-thickness burn wounds represents a challenge when reconstructive options are not applicable. Fetal bovine dermal matrix is a bioactive collagen scaffold that assimilates into wounds and stimulates vascularization and dermal regeneration.[36]

Analysis of antibiotic consumption in burn patients:

The study was to determine the effect of antibiotic therapy on the emergence of antibiotic-resistant bacteria. 525 strains of Pseudomonas aeruginosa, Acinetobacterbaumannii and Staphylococcus aureus were isolated from 335 hospitalized burn patients. Antibiotic susceptibility tests were performed after identification the strains. The records of patients were audited to find the antibiotic used. The results indicated that P. aeruginosa is the most prevalent Gram-negative bacteria. Further, it showed a relation between abuse of antibiotics and emergence of antibiotic resistance. Control of resistance to antibiotics by appropriate prescription practices not only facilitates prevention of infection caused by multi-drug resistant (MDR) microorganisms, but it can also decrease the cost of treatment. [37]

Experimental phage therapy of burn wound infection:

Antibiotic resistance has become a major public health problem and the antibiotics pipeline is running dry. Bacteriophages (phages) may offer an 'innovative' means of infection treatment, which can be combined or alternated with antibiotic therapyand may enhance our abilities to treat bacterial infections successfully. They describe the application of a well-defined and quality controlled phage cocktail, active against Pseudomonas aeruginosa and Staphylococcus aureus, on colonized burn wounds within a modest clinical trial (nine patients, 10 applications). Nevertheless, this first 'baby step' revealed several pitfalls and lessons for future experimental phage therapy and helped overcome the psychological hurdles that existed to the use of viruses in the treatment of patients in our burn unit.[38]

Thermal injury of humans causes arguably the most severe perturbations in physiology that can be experienced. These physiologic derangements start immediately and can persist in some form until months or even years after the burn wounds are healed. Burn shock, marked activation of the systemic inflammatory response, multiple-organ failure, infection, and wound failure are just a few of the insults that may require management by the intensivist.[39]

Trace element supplementation following severe burn injury:

Trace elements have an important physiological role after severe burn injury with patients routinely receiving supplementation. Supplementation of selenium, copper and zinc, either alone or combined, compared with placebo or standard treatment were eligible for inclusion. Predetermined primary outcome measures were mortality, length of stay, rate of wound healing, and complications. The results indicate that the use of parentally administered combined trace elements after burn injury confer positive effects in decreasing infectious complications. Combined parenteral trace element

supplementation and combined oral and parenteral zinc supplementation have potentially clinically significant findings on reducing length of stay. Oral zinc supplementation shows possible beneficial effects on mortality. Definitive studies are required to accurately define optimal trace element supplementation regimens, dosages, and routes after burn injury.[40]

Burn ear reconstruction using porous polyethylene implants and tissue expansion:

Reconstruction of the external ear after a burn is particularly challenging. The use of costochondral grafts often leads to marginal outcomes which do not justify the morbidity. Children under the age of 10 years commonly have insufficient cartilage for a graft. Medpor (Stryker, Kalamazoo, MI) offers minimal morbidity and a very effective result. The experience has shown porous polyethylene reconstruction to be very efficient, with low morbidity and good cosmetic outcomes. Medpor is an excellent option for the reconstruction of both fully and partially burned ears as you may implant only the helical rim, base, or both pieces. The best results were achieved after tissue expansion and the use of the alopecic skin overlying a temporoparietalfascial flap. This has become the preferred method.[41]

Burns increase the metabolic demands of the body and can lead to severe weight loss and increased risk of death. Early enteral support is believed to improve gastrointestinal, immunological, nutritional and metabolic responses to critical injury; however, this premise is in need of further substantiation by definitive data. This examine the effectiveness and safety of early enteral feeding in paediatric patients suffering from burns.[42]

Silver-impregnated dressings are increasingly preferred over silver sulfadiazine cream in the management of pediatric burns. An ideal burns dressing would provide a moist, sterile environment, discourage infection, and not require painful dressing changes. This study sought to determine whether silver sodium carboxymethyl cellulose (Aquacel Ag) dressing is a superior treatment to nanocrystalline silver-coated polyethylene (Acticoat) dressing in pediatric patients with partial thickness burns. [43]

Video-enhanced telemedicine for burns:

The acute care of burn patients is critical and can be a daunting experience for emergency personnel because of the scarcity of burn injuries. Telemedicine that incorporates a visual component can provide immediate expertise in the treatment and management of these injuries. The authors sought to evaluate the addition of video telemedicine to our current telephone burn transfer program. The accuracy of burn size estimations (BSA burned) and management changes (fluid requirements, transfer mode, and final disposition) were analyzed between the telephones-only sites (T only) and the video-enhanced sites. This study reports the successful implementation of video-enhanced telemedicine pilot project in a rural state. Video-enhanced telemedicine using a store and forward process improved burn size estimation and facilitated management changes.[44]

Music intervention on background pain and anxiety in burn patients:

This study was aimed to investigate the effect of music on the background pain, anxiety, and relaxation levels in burn patients. Music is an inexpensive, appropriate, and safe intervention for applying to burn patients with background pain and anxiety at rest. To produce more effective comfort for patients, it is necessary to compare different types and time lengths of music intervention to find the best approach [45].

Heart rate variability as a predictor of death in burn patients:

Heart rate variability (HRV), a noninvasive technique used to quantify fluctuations in the interval between normal heart beats (NN), is a predictor of mortality in some patient groups. The study was to assess HRV in burn trauma patients as a predictor of mortality. The authors prospectively performed 24-hour Holter monitoring on burn patients and collected demographic information, burn injury details, and in-hospital clinical events. Analysis of HRV in the time and frequency domains was performed.[46]

Long-term outcomes in patients surviving large burns: the musculoskeletal system:

The study was to describe the long-term musculoskeletal complications following major burn injury. This is a cross-sectional descriptive study that includes a one-time evaluation of 98 burn survivors. This study underscores the importance of long-term follow-up care and therapeutic interventions for survivors of major burn injury, as they continue to have significant and persistent burn-related impairments even several years following injury.[47]

An evaluation of factors related to postoperative pain control in burn patients:
The perioperative period is particularly challenging. The contributions of acute tolerance and opioid-induced hyperalgesia have not been previously explored in burn patients. While this study is retrospective, there is a suggestion that opioid amounts given pre-OR and intraoperatively are correlated with worse post-OR pain. While an increase in pain ratings postoperatively are anticipated, the additional contributions of acute tolerance and opioid-induced hyperalgesia need to be determined. Pharmacologic intervention directed at these mechanisms can then be administered to achieve better postoperative pain control.[48]

Elevations in inflammatory cytokines are associated with poor outcomes in mechanically ventilated burn patients:
Severe burn provokes a systemic inflammatory response characterized by the release of a host of cytokines. Recent studies evaluated the prognostic value of temporal changes in cytokine levels in several patient populations, but few have compared differences in the cytokine profiles of survivors and non survivors following severe burn. They previously compared high-frequency percussive ventilation and low-tidal-volume ventilation and found no difference in mortality or cytokine levels between the two treatments. Since it is unknown whether cytokine levels are predictive of mortality in these patients, They performed a post hoc analysis comparing cytokine levels in survivors and non survivors.[49]
Use of a copolymer dressing on superficial and partial thickness burns in a paediatric population:
Designed to evaluate the efficacy and outcomes of the application of copolymer dressing for both superficial and deeper partial-thickness burns. Fully synthetic copolymer dressing is easy to apply, does not require any additional antimicrobial coverage and may be used to successfully manage deeper partial-thickness burns, donor sites or burns in areas of contour, where many other dressings might not be considered or be appropriate.[50]
Systematic review of the effect of propanolol on hyper metabilism in burn injuries:
The use of propranolol has been proposed to reduce the hypermetabolic response of patients with burninjuries. Propranolol at doses adjusted to decrease the heart rate by 20% of the baseline value (4–6 mg/kg/day p.o.) reduces supraphysiological thermogenesis, cardiac work, resting energy expenditure and peripheral lipolysis. It likewise increases the efficiency of muscular protein synthesis and reduces central mass accretion. Propranolol reduces the hypermetabolic response in pediatric burn patients. More studies on its effects in adult burn patients are needed.[51]
Management of cyanide toxicity in patients with burns:
The importance of cyanide toxicity as a component of inhalational injury in patients with burns is increasingly being recognized, and its prompt recognition and management is vital for optimizing burns survival. The evidence base for the use of cyanide antidotes is limited by a lack of randomized controlled trials in humans, and in addition consideration must be given to the concomitant pathophysiological processes in patients with burns when interpreting the literature. They conclude that hydroxycobalamin should be utilized as the first-line antidote of choice in patients with burns with inhalational injury where features consistent with cyanide toxicity are present.[52]

CONCLUSION

Recent trends in burn cure management was studied using 122 articles that covers quantitative as well as qualitative research methods were included, resulting in a comprehensive overview of existing published research. The aim of the present study is to analyze the changes of cure rate and the main causes of death in the last 40 years. The cure rate increased significantly in the recent years, and the main causes of death changed from shock and sepsis in the time period 1959–1978 to sepsis and MODS in the past two decades. Due to the improvement of early comprehensive management of burn shock, aggressive surgical approach to burn wound and potent systemic supporting measures, the survival rate increased significantly.

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