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The epidemiologic drift of infectious agents in burn patients

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Abstract

Burns are among the most devastating medical conditions, causing both physical and psychological trauma that can persist long after the initial injury. Despite significant advancements in modern medical care, including burn centers, burn patients remain at a heightened risk of infection due to the favorable environment for bacterial growth in the affected areas and the prolonged hospital stays often required for treatment. Infections are a major concern for burn patients, as they can lead to serious illness and even death, despite the use of strong antibiotics. Treatment strategies for burns depend on the type of burn wound, and it is crucial to stay up to date on the epidemiologic shift of species over time in order to update empirical therapy. Recent research has shown that gram positive species, specifically Staphylococcus aureus and Staphylococcus epidermidis, have remained prevalent over the past two years, while Klebsiella pneumoniae and Pseudomonas aerogenes have been the most common gram-negative species in 2020 and 2021 respectively. Candida albicans has been the most commonly found fungi throughout this period.

Keywords: Paternalistic Leadership, Organization Citizenship Behavior, Effectiveness

1 Introduction

Burns represents one of the most formidable conditions encountered in medicine, affecting the physical and psychological aspects of the patient. It is a condition that affects all age groups, from neonates to the elderly, and is a global issue. Despite the fact that even small burns can cause significant pain, the agony and suffering caused by a severe burn injury extend beyond the acute

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phase (Luterman et al., 1986). Burn injuries result in both visible physical scarring and less visible psychological trauma, both of which may have a lasting impact on the individual and lead to chronic disability. The management of burn injuries presents a challenging and complex task for healthcare providers, as it involves a diverse range of considerations that require a multidisciplinary approach. To provide effective care, healthcare professionals must possess the necessary skills and expertise to address the physical, psychological, and social issues that burn patients face, and work collaboratively to deliver comprehensive and holistic care. Burn injuries are a prevalent and incapacitating form of trauma. Patients who suffer from severe thermal injuries necessitate prompt and meticulous management in order to mitigate morbidity and mortality (Deitch et al., 2023). The survival rates for burn victims have significantly increased over the past few decades because to developments in contemporary medicine, notably at specialized burn centers. However, in patients with severe burns that affect more than 40% of their total body surface area (TBSA), up to 75% of all deaths are currently attributed to sepsis resulting from infection of burn wounds (Weinstein & Mayhall, 2003).

A patient who has had burns is regarded as seriously unwell. Therefore, initial evaluation and resuscitation attempts concentrate on the patient's airway, breathing, and circulation as well as a check for any further damage than the burn itself. A comprehensive evaluation of the burn injury should include an assessment of its etiology and degree. While assessing the degree and severity of all types of burn injuries can be challenging, chemical burns are particularly difficult to evaluate. The severity of these injuries not only depends on the affected skin surface area but also on the chemical agent involved and the duration of exposure. In certain cases, even small areas of injury, such as alkali burns to the eye or inhalation of vapors like anhydrous ammonia, can lead to significant morbidity due to systemic effects from absorption(Vivó et al., 2016). Burns provide a favorable environment for bacterial colonization and are more challenging to manage compared to surgical wounds due to their larger surface area and prolonged hospital stay. An important contributor to morbidity and mortality is still infection. In hospitalised burn patients, infection continues to be a substantial source of morbidity and death, with 50-60% of deaths attributed to infectious complications despite intensive treatment with both topical and intravenous antibiotics(Hammoudi, 2014).

After a burn injury, the majority of patients experience severe bacterial infection-related complications, which are the most frequent barrier to reducing morbidity and death. Burn injuries damage the skin's natural defenses, which triggers both local and systemic immunological reactions and raises the possibility of microbial infection. Different factors affect the percentage of burn fatality. The level of burn is the most crucial element (Williams et al., 2009). In general, the common cause of mortality in severely burn injuries is infection or difficulties of inhalation damage. Burn injuries result in an anti-inflammatory response, which causes immunosuppression, which in turn causes infection, which is shown by a drop in monocytes and macrophages following the burn damage and infection (Jasem et al., 2018).

In burn patients who have survived the initial resuscitation from shock, multiple organ dysfunction syndromes (MODS) leading to sepsis is the primary cause of mortality. This is seen in every patient hospitalised to the critical care unit (ICU) (Greenhalgh, 2017).

Infection is a major concern for burn patients and is a leading cause of morbidity and mortality in this patient population. Preventing and controlling infections in burn units requires a clear understanding of how and why they occur. Over the past 24 years, colonized patients have been identified as a common feature associated with burn unit outbreaks. It is believed that the pathogen strain that is causing the outbreak is present in these individuals. Contaminated beds, common treatment spaces, and hydrotherapy equipment are a few more significant sources of infection.

These sources tend to pose particular concerns of cross-contamination in burn settings. In burn units, other significant transmission routes include staff hands and contact with improperly sanitised equipment or surfaces. When caring for burn patients, the hands and apron region of the patient, as well as surfaces like beds, side rails, tables, and equipment that are frequently contaminated with organisms from the patient, are the area's most prone to get polluted. Additionally, all tools used on the patient, including IV pumps, wheelchairs, thermometers, and blood pressure cuffs, are highly contaminated and might spread disease to other patients if adequate decontamination is not carried out and strong barriers are not upheld. To lower the risk of infection and enhance patient outcomes, preventing and treating infections in burn units necessitates a multidisciplinary strategy that involves good hygiene procedures, attentive patient management, and judicious use of antibiotics (Weber et al., 2004).

Burn patients are particularly vulnerable to infections due to the disruption of their skin barrier and immune system. Infections are a major cause of morbidity and mortality among these patients, and can impair wound healing, lead to graft loss, prolong treatment, lengthen hospitalization, and increase costs. Burn wounds, respiratory tract, urinary tract, and bloodstream are the most common sites of infection. The epidemiology of infections in burn patients differs from that in non-burned patients, necessitating a specific and multidisciplinary approach. Although burn wounds are sterile immediately after injury, they become colonized with various microorganisms during hospitalization (Macedo-Viñas, 2017).

Author	Research	Frequency in United Kingdom	Differential departments	Count	Total Death per year
Hettiaratchy, Shehan Dziewulski, Peter	ABC of Burns	250,000 per year	Accident and Emergency	175,000	300
			Hospital Admitted	13,000	
			Fluid Resuscitation	1000	
			Death	300	

Table 1.1. Statistics of burn patients in UK for the year 2004(11)

Burn injury is the result of exposure of the skin or other tissues to thermal, chemical, electrical, frictional or radiant energy sources. The most common causes of burns are hot liquids (scalds), flames or contact with hot objects. Factors such as alcohol consumption and smoking are associated with an increased risk of burns. Additionally, burns can occur as a result of intentional self-harm or interpersonal violence. Among men, occupational exposure is a significant risk factor for burn injury.

Only the top layer of skin is affected by superficial or first-degree burns, which are red and lack blisters. Usually, pain lasts for three days. Partial-thickness or second-degree burns are defined as injuries that penetrate some of the deeper layers of skin. There are often blisters, and the agony can be very intense. Scarring may appear during the eight-week healing period. All layers of the skin are affected by a third-degree or full-thickness burn. In most cases, there is no discomfort, and the affected area stiffens. Without outside help, healing cannot take place. Injury to deeper tissues, such as muscle, tendons, or bone, constitutes a fourth-degree burn. The burn is frequently black, and the tissue injured by it could completely disappear (Hettiaratchy & Dziewulski, 2004b).

The objective of this review is to provide insight into the epidemiology of recent burn wounds, which can assist in the early empirical treatment of burn patients, potentially reducing the risk of complications before the availability of definitive blood culture and sensitivity reports.

1.1 Materials and methods

This is an article review for the past two years i.e.: 2020 and 2021. Literature was searched in PUBMED using keywords Infection, burn wounds, sepsis and pathogens in burn wounds.
Only blood stream infections were selected for this review. Wound infections were excluded from this study.

2 Results

As per data extracted from the papers, in 2020 only 10% of the total sample population was infected while in 2021 13.5% was infected. Majority of the population affected was male 68.4% and 66.1% compared to females 31.6% and 33.9% in 2020 and 2021 respectively.

Staphylococcus aureus was highly prevalent in 2020 (32.35%) compared to 2021 (4.45%). Staphylococcus epidermidis, Staphylococcus capitis, Staphylococcus haemolyticus, Enterococcus faecium, Enterococcus faecalis, Streptococcus pneumoniae and Streptococcus oralis were not found in any culture while they were reported to be 36.36%, 1.81%, 1.81%, 1.81%, 5.45%, 1.81%, 1.81% and 1.81% respectively. Enterobacter cloacae was reported to be 5.88% in 2020 compared to 2021 which was 5.45%. Klebsiella pneumoniae was high in 2020 (17.65%) compared to 2021 (9.09%). Escherichia coli, Enterobacter aerogenes, Citrobacter freundii and Serratia rubidaea were not reported in 2020 while in 2021 they were found to be 9.09%, 1.81%, 1.81% and 1.81% respectively. Haemophilus influenzae was reported to be 2.94% in 2020 while it was not reported in 2021 at all. Serratia marcescens was not reported in 2020 but was reported to be 1.81% in 2021. Acinetobacter baumannii was reported in 2020 to be 8.82% while in 2021 it was reported to be 5.45%. Candida albicans in 2020 was 2.94% while in 2021 it was 3.63%. Candida glabrata was not reported in 2020 but was reported to be 1.81% in 2021. Pseudomonas aeruginosa was found to be 2.94% and 20% in 2020 and 2021 respectively. Coagulase-negative Staphylococcus was reported to be 26.48% in 2020 while it was not reported in 2021 at all (Mater et al., 2020; Costescu Strachinaru et al., 2022).

Details of microorganisms isolated from blood stream through culture.

Species/year	2020	2021
Staphylococcus aureus	32.35%	4.45%
Staphylococcus epidermidis	0%	36.36%
Staphylococcus capitis	0%	1.81%
Staphylococcus haemolyticus	0%	1.81%
Enterococcus faecium	0%	1.81%
Enterococcus faecalis	0%	1.81%
Streptococcus pneumoniae	0%	1.81%
Streptococcus oralis	0%	1.81%
Bacillus cereus	0%	1.81%
Enterobacter cloacae	5.88	5.45
Klebsiella pneumoniae	17.65	9.09
Escherichia coli	0%	9.09
Enterobacter aerogenes	0%	1.81%
Citrobacter freundii	0%	1.81%
Serratia rubidaea	0%	1.81%
Haemophilus influenzae	2.94%	0%
Serratia marcescens	0%	1.81%
Acinetobacter baumannii	8.82%	5.45%
Candida albicans	2.94%	3.63%
Candida glabrata	0%	1.81%

Pseudomonas aeruginosa	2.94%	20%
Coagulase-negative Staphylococci	26.48%	0%

Table 1.1; details of species isolated from blood culture of burn patients in 2020 and 2021

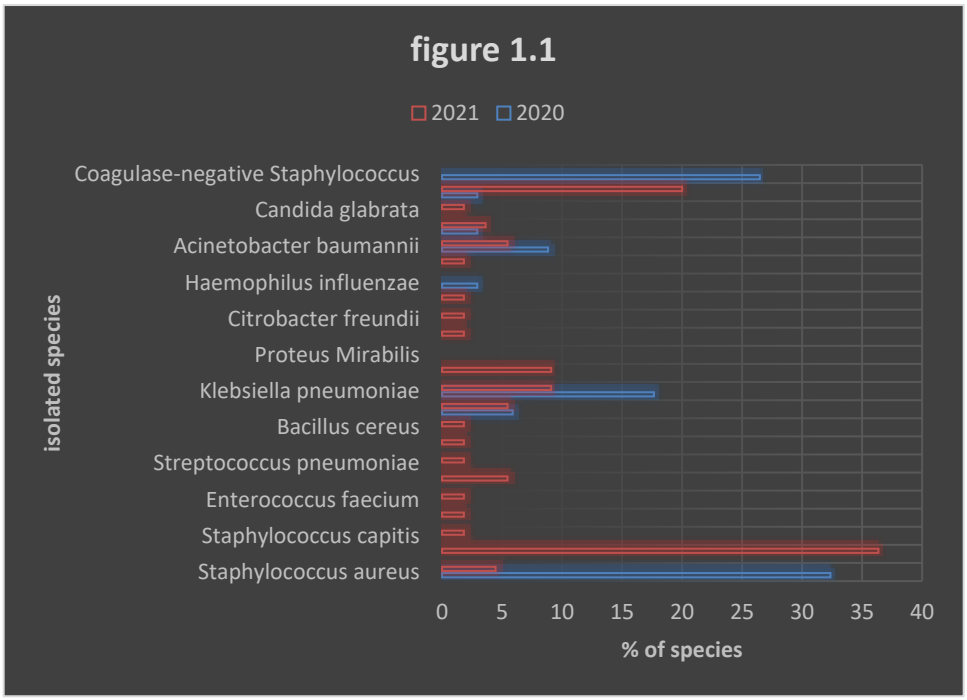

Fig 1.1; details of species isolated in 2020 and 2021 from blood culture of burn patients

3 Conclusion

Overall infection was increased from 10% to 13.5% in 2021. In gram positive species, staphylococcus aureus remained prevalent in 2020 while staphylococcus epidermidis remained high in 2021. Among gram negative species, klebsiella pneumoneae remained high in 2020 while pseudomonas aerogenes remained high in 2021. Candida albicans was the most common fungi found throughout.

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