International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

Check for updates

Antibiotic resistance assessment at the burns unit of Batna University Hospital (2020-2022)

Amel Benbouza [1, 2, *], Nora Righi [2, 3], Nawel Boudouh [2, 4] and Messaoud Bouraara [2]

[1] *Cancer Treatment Center -Batna, Algeria.*
[2] *Medecine Department, Batna 2 University, Algeria.*
[3] *Public hospital establishment- Batna, Algeria.*
[4] *University Hospital Center- Batna, Algeria.*

International Journal of Science and Research Archive, 2024, 12(02), 1083–1087

Publication history: Received on 06 June 2024; revised on 21 July 2024; accepted on 23 July 2024

Article DOI: https://doi.org/10.30574/ijsra.2024.12.2.1328

Abstract

The burn patient's infection is a major and often dreaded complication in the management of patients with severe burns, and is also one of the main causes of morbidity and mortality in these patients. A retrospective study was carried out in the burns department (Batna HUC), over a two-year period (2020-2022), with the aim of assessing the antibiotic resistance of strains isolated from burns patients hospitalized during this period. According to data collected from patient records, thermal etiology was the most common cause of burns (97.8%), with equal distribution between the sexes, with a sex ratio of 1.02. The age group most affected was children under 12. The majority of burns were deep 2nd degree (46.6%). Among the 363 burns patients hospitalized in the department, 35 had an unfavorable outcome. Pus was the origin of the 83 bacterial species isolated, the most incriminated were: Pseudomonas aeruginosa (27.3%) followed by Klebsiella pneumoniae (12.7%), then Staphylococcus aureus (11.8%). Susceptibility of isolated strains to antibiotics varied according to the family. For Pseudomonas aeruginosa, ESBL production was noted in 36.11%, and carbapenemase in 78.57%. In the case of Staphylococcus aureus, resistance to meticillin concerned 92.30% of isolates, with associated resistance to other antibiotic families, notably fusidic acid and ofloxacin (92.31%), gentamycin 90%. The frequency of isolation of ESBL-producing Enterobacteriaceae in the present study was 73.33%; 21.48% of isolated strains produced carbapenemase. By adopting judicious prescribing practices and promoting the responsible use of antibiotics, we can help preserve their efficacy in the management of infections in burn patients, in an attempt to eradicate the emergence of resistant germs.

Keywords: Burns; Antibiotics; Bacterial resistance; HUC

1. Introduction

The many origins of bacterial contamination in burns wards entail major risks of dissemination, leading to nosocomial infections. The prognosis of these patients is therefore often linked to severe septic complications due to potentially virulent or even multi-resistant germs, sometimes the source of extremely serious epidemics [1]. In recent years, antibiotic resistance has become a major public health issue worldwide, affecting a growing number of patients in both hospital and community settings. Despite numerous recommendations and awareness campaigns, this worrying situation is worsening, as antibiotic resistance is likely to become one of the main causes of mortality worldwide in the near future [2]. The aim of this study is to determine the epidemiology of germs isolated from patients hospitalized at the burns unit in Batna University Hospital, and to identify their resistance profile to different antibiotics.

* Corresponding author: Amel Benbouza

2. Material and methods

We carried out a descriptive retrospective statistical study of the medical records of patients admitted to the Batna burn center (Algeria) over the period from April 2020 to April 2022. The local care protocol includes a betadine shower, followed by the application of a trolamine-based emulsion such as Biafine. It ends with an occlusive oily dressing every other day.

2.1. Cutanuous sampling

Swabs were taken at irregular intervals, depending on the appearance of the burn lesions and secretions at the time of dressing. For each sample, two swabs were used, one for direct examination and the other for culture and enrichment.

2.1.1. Hemoculture

Samples are routinely taken in the presence of clinical or paraclinical signs of sepsis, hyperthermia (T > 38.5°C) or hypothermia (T < 36.5°C). The culture medium is citrated liquid broth.

UCBE: samples are taken weekly or when clinical signs appear.

2.1.2. Urinary catheter tip

This is systematically cultured when the catheter is changed.

2.1.3. Catheter

The catheter tip is cultured whenever the catheter is changed.

All isolated strains are phenotypically identified and tested for antibiotic susceptibility

3. Results

The study showed that the majority of burns were thermal (97.8%) with an equal distribution for both sexes, the majority of lesions were 2nd degree (86.6%), divided between superficial (40%) and deep (47.6%). More than half the patients were children under 12 years of age (54%). A total of 363 microbiological samples were collected over the years of the study, only 42 were positive for 83 micro-organisms. It should be noted that all the samples returned positive were pus, and all were polymicrobial. Isolates were composed of 84% Gram-negative bacteria (BNF and Enterobacteriaceae) and 16% Gram-positive bacteria.

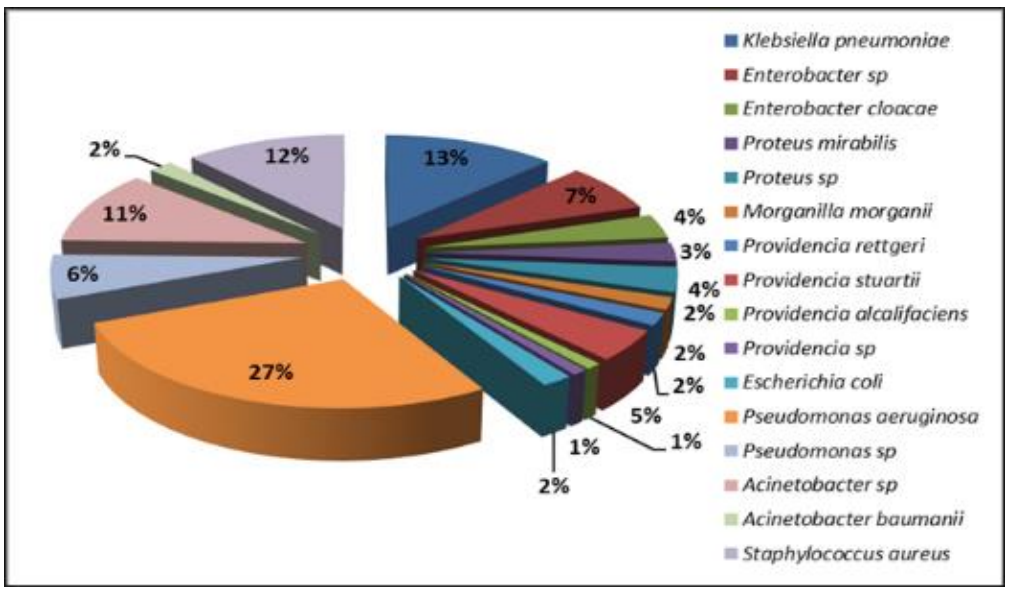

Figure 1 Distribution of bacterial strains by species

Among Gram-negative bacteria, 46% of isolates were non-fermenting, dominated by Pseudomonas (35%) with the subgroups: aeruginosa (27%), sp. (6%); and Acinetobacter with 11% for sp. and 2% for baumanii. The frequency of enterobacteria was 38%, led by Klebsiella pneumoniae (13%), followed by Enterobacter sp. and Escherichia coli. Other species of enterobacteria were isolated, but at a lower frequency. Among Gram-positive bacteria, Staphylococcus aureus was the only species isolated, with an estimated percentage of 16% (Fig 1). A favorable outcome was noted in over 90% of burn patients, with a mortality rate of 9.6%. The sensitivity profile of the isolates was variable: among the enterobacteria isolated (32 strains), ESBL production was noted in most strains (73.33%), while carbapenem resistance through carbapenemase production was demonstrated in 21.48% of isolates (Fig 2).

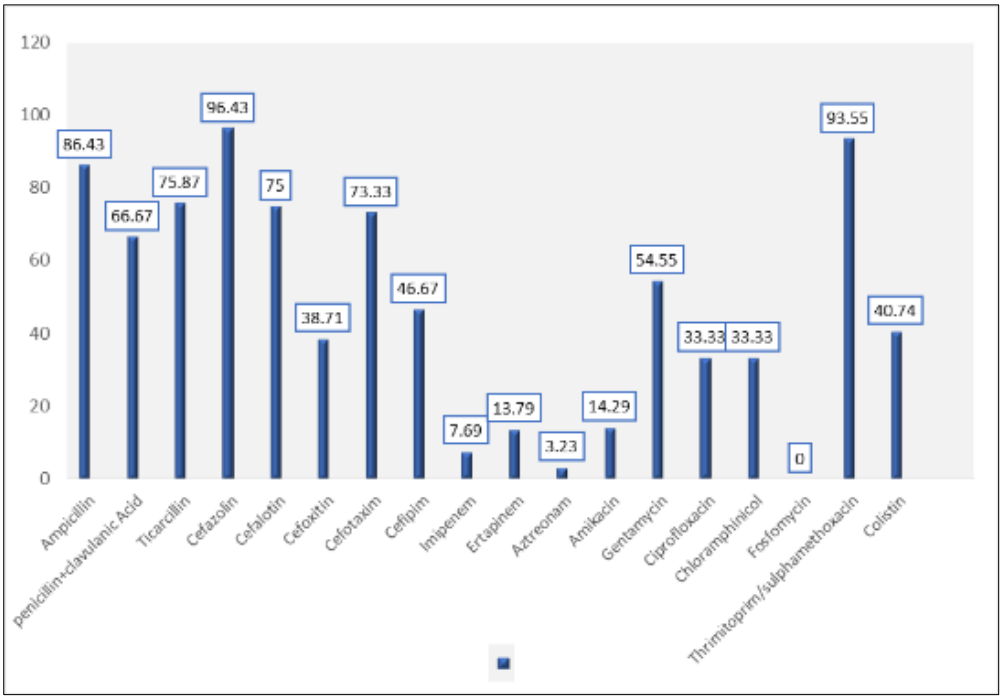

Figure 2 Susceptibility profile of isolated Enterobacteriaceae species

For BNF, of which there were 38, ESBL was produced in 36.11% of strains. While imipenem resistance was found in 78.57% of isolates (Fig 3).

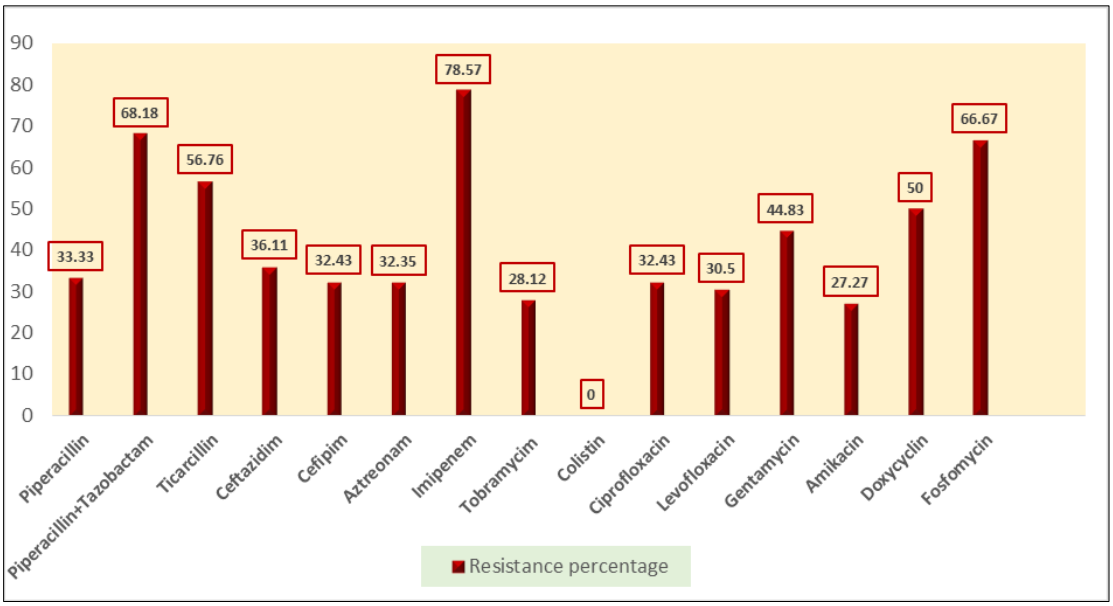

Figure 3 BNF sensitivity profile

The frequency of MRSA was 92.30%, with associated resistance to gentamicin, fusidic acid, rifampicin and ofloxacin, with frequencies of 90%, 92.31%, 76.92%, 92.31%, respectively; however, no resistance to glycopeptides was objectified (Fig 4).

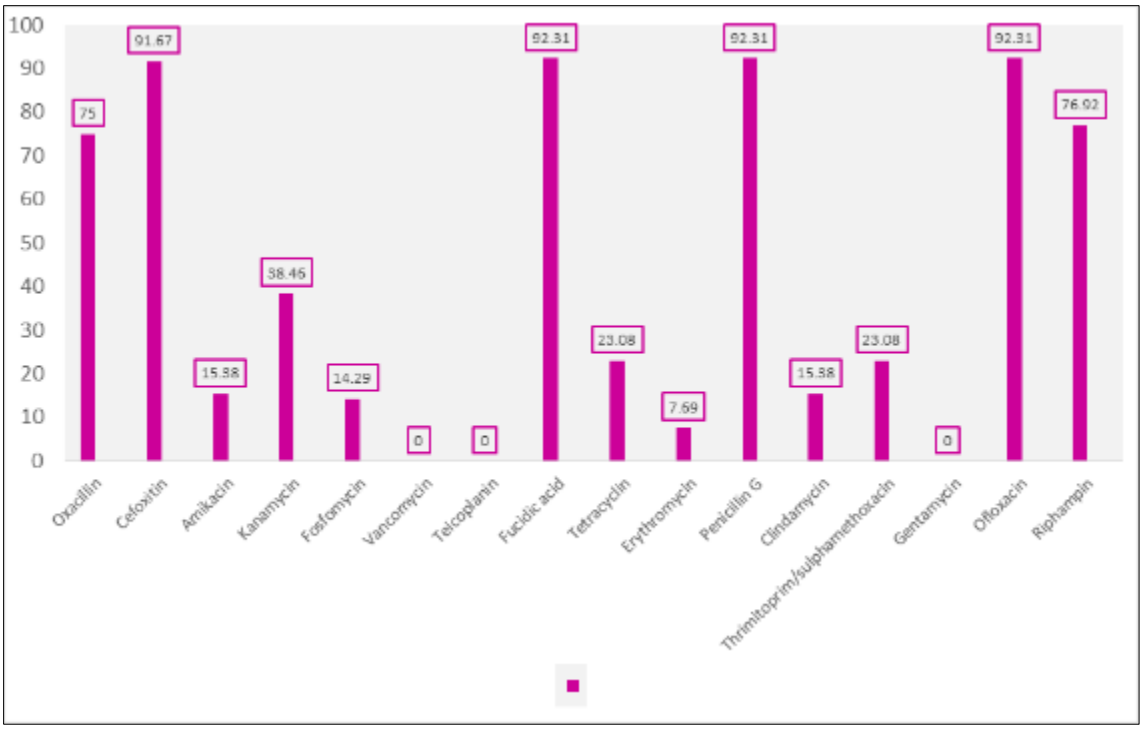

Figure 4 Staphylococcus aureus susceptibility profile

4. Discussion

Burn patients with severe injuries require immediate specialist care to minimize morbidity and mortality [3]. The present study showed that thermal burns occupy first place (97.8%) in the causes of burns, a result corroborating several studies [4,5]. Our study showed that the mortality rate among burned patients was 9.6%, mainly due to septic shock, which was lower than that reported by Tchakal-Mesbahi (12%) [2] and significantly lower than other studies, Hossam (80%) and Parvoni et al (54%) [6,7]. In nosocomial infections, particularly those contracted in burn patients, the literature relating to burn centers incriminates Gram-positive germs as the agents responsible for early infection. The flora described classifies Staphylococcus epidermidis in the first 24 h, and Staphylococcus aureus in the first week. Further, Gram-negative bacteria emerge, with Pseudomonas aeruginosa predominating [8-10]. According to our results, *Pseudomonas aeruginosa* ranks first among the germs responsible for burns infections (27%), followed by Staphylococcus aureus (16%) and Klebsiella pneumoniae (13%). Similar results have been reported in other studies [11-13]. Antibiotic resistance in bacteria is a growing concern worldwide. The evolution of bacteria towards antibiotic resistance, or even total resistance, is inevitable, as it is an integral part of the general evolution of bacteria and cannot be stopped. Antibiotic resistance in isolated strains varied according to group, from high-level penicillinase to extended-spectrum bêta-lactamase in Gram-negative strains, to antibiotics considered to be those of last resort: Imipenem, by carbapenemase production (21.48% for enterobacteria and 78.57% for BNF). Our results are almost identical to those found in Canton's study, which reported that: "Bacterial infections of burns are the main cause of mortality and morbidity at a burns care unit". The most serious infections are caused by Gram-negative microorganisms, which can increase mortality rates by at least 50%. Among these, Pseudomonas aeruginosa is the main cause of mortality, particularly due to the emergence of multi-resistant strains"[14]. For Gram-positive Staphylococcus aureus, 92.30% of strains were MRSA, with resistance associated with gentamicin (90%), fusidic acid (92.31%), ofloxacin (92.31%), and rifampicin (76.92%). A large body of published data indicates that MRSA is the main nosocomial pathogen, and our results corroborate those found in the study carried out at the burns unit of the DMCH in Bangladesh, which demonstrated a high level of resistance associated with these MRSA [15].

5. Conclusion

This epidemiological study, carried out in the burns department of the CHU Batna (Algeria), involved 363 cases, of which only 42 had a documented infection. It revealed the predominance of Pseudomonas sp, Klebsiella pneumonia and Staphylococcus aureus. Good vigilance, with reinforced hygiene measures, reasoned use of antibiotics and epidemiological monitoring of bacteria, are necessary at both burn unit and hospital level, to avoid epidemic risks of multi-resistant or even highly resistant germs.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] Perro G., Bourdarias B., Cutillas M., Castède J-C., Sanchez R. Epidemiological analysis of 2000 burn victims hospitalised in Bordeaux between 1987 and 1994. Annals Burns and Fire Disasters. 1996 ;9:131-8.

[2] A.Veyssiere, Antibiotic resistance in the bacteria most commonly encountered in community infections - 2019 update.pdf.

[3] Santucci SG, Gobara S, Santos CR, Fontana C, Levin S. Infections in a burns intensive care unit: seven years' experience. J Hosp Infect. 2003; 53: 6-13

[4] Siah S Belefqih R.,2 Elouennass M.,3 Fouadi F.E.,1 Ihrai I. Annals of Burns and Fire Disasters - vol. XXII - n. 2 - June 2009 NOSOCOMIAL INFECTION IN INTENSIVE CARE FOR BURN VICTIMS

[5] Ayoub Abdennour. (2018). Hand burns: epidemiological, clinical and therapeutic data 207(104-105).

[6] H. Mohamed, « One year prevalence of critically ill burn wound bacterial infections in surgical ICU in Egypt: Retrospective study », Egypt. J. Anaesth., vol. 32, no 3, p. 431-434, juill. 2016, doi: 10.1016/j.egja.2016.01.005.

[7] V. Pavoni, L. Gianesello, L. Paparella, L. T. Buoninsegni, et E. Barboni, « Outcome predictors and quality of life of severe burn patients admitted to intensive care unit », Scand. J. Trauma Resusc. Emerg. Med., vol. 18, no 1, p. 24, déc. 2010, doi: 10.1186/1757-7241-18-24.

[8] Ezzoubi M., Ettalbi S., Elmounjid S., Mradmi W., Bahechar N., Boukind E. Infection in a burns unit. Annals of burns and catastrophic fires. 2004; 17: 81-3.

[9] Perro G., Bourdarias B., Cutillas M., Castède J.-C., Sanchez R. Study of bacterial ecology over six years in a burns unit: Relationship with nosocomial infections and anti-infective therapies. Annals of burns and catastrophic fires. 1996; 9: 46-52.

[10] A. Tchakal-Mesbahi, M. A. Abdouni, et M. Metref, « Prevalence Of Multidrug-Resistant Bacteria Isolated From Burn Wounds In Algeria », Ann. Burns Fire Disasters, vol. 34, no 2, p. 150-156, juin 2021.

[11] A. Chaibdraa et M. C. Bentakouk, « Bacteriological study over 30 months in a burn unit », Ann. Burns Fire Disasters, vol. 21, no 1, p. 7-12, mars 2008.

[12] Revathi, G., Puri, J. and Jain, B.K. (1998) Bacteriology of Burns. Burns, 24, 347-349.http://dx.doi.org/10.1016/S0305-4179(98)00009-6

[13] R. Kaushik, S. Kumar, R. Sharma and P. Lal, "Bacteriology of Burn Wounds—The First Three Years in a New Burn Unit at the Medical College Chandigarh," Burns, Vol. 27, No. 6, 2001, pp. 595-597. http://dx.doi.org/10.1016/S0305-4179(01)00023-7

[14] R. Cantón et M.-I. Morosini, « Emergence and spread of antibiotic resistance following exposure to antibiotics », FEMS Microbiol. Rev., vol. 35, no 5, p. 977-991, sept. 2011, doi: 10.1111/j.1574-6976.2011.00295. x.

[15] Islam, M., Ahmed, M. et Rahman, S. (2013). Incidence of methicillin-resistant Staphylococcus aureus in burn patients admitted to burn unit, Dhaka Medical. Advances in Microbiology, 3 , 498-503. doi: 10.4236/aim.2013.36066