Research Article

Microbiology and Antimicrobial Susceptibility Patterns of Wound Cultures of Burn Patients

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Abstract

Background: Antimicrobial susceptibility patterns play an important part in the management of burn wound infections, a common cause of morbidity & mortality. We evaluated the antibiogram of burn wounds at Jinnah Burn and Reconstructive Surgery Center, Lahore, Pakistan which is one of largest burn centers in the country.

Methodology: Retrospective observational study of burn patients. Our study included all kinds of burns and all admitted patients with all ages, total burn surface area 01-80%. Wound cultures and sensitivity done on wounds swabs by culture and disc diffusion methods.

Results: There were 1774 cases included in this study. The most common organism isolated in this study was Pseudomonas species, followed by Acinetobacter species, Klebsiela. Colistin showed best sensitivity against gram negative bacteria isolated in this study. Other antibiotics discs used were Imipenem, Meropenem, Doxycycline, Ciprofloxacine, Levofloxacine, and others

Conclusion: Pseudomonas species is the most common organism found in cultures of burn wounds and Colistin shows best sensitivity results against all bacteria found in our reports including Klebsiella and, Acinetobacter species.

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Introduction

Microbiology and antimicrobial susceptibility patterns play a crucial role in the management of burn wound infections.[1] In the care of burn patients, the identification of the causative microorganisms and their antibiotic resistance profiles is essential for the selection of appropriate empirical and targeted therapy for systemic as well as topical.[2] Despite the advancement of modern wound care practices, infections remain one of the major complications of burn injuries and contribute significantly to morbidity and mortality.[3,4] This article will provide a comprehensive overview of the microbiology and antimicrobial susceptibility patterns of wound cultures in burn patients and its impact on the management of burn wound infections.

According to the World Health Organization (WHO), it is estimated that each year approximately 11 million people suffer from burn wounds, 180,0004. Burn wounds are often colonized by a variety of microorganisms. The most commonly isolated bacteria from burn wound cultures include Pseudomonas aeruginosa, Staphylococcus aureus, Acinetobacter species, Klebsiella species, Enterobacter species, Proteus species, and others.[5] The composition of the burn wound microbiome can be influenced by several factors, including the severity of the burn injury, the type of burn, the presence of underlying comorbidities, and the patient's immune status. In addition, the microbial flora of the burn wound can also be influenced by the type of wound care practices, the use of topical antimicrobial agents, and the duration of wound care.[6]

The widespread use of antibiotics has already led to the emergence of antibiotic resistant bacteria, including methicillin resistant Staphylococcus aureus (MRSA),[7] extended spectrum beta lactamase (ESBL) producing gram negative bacteria, and carbapenem resistant Klebsiella pneumonia[8] and many other resistant species. The resistance patterns of bacteria isolated from burn wounds can vary depending on the geographical location and the patient population. Gram positive bacteria may be more common[9] in some places than gram negative.[10,11]

The knowledge of the microbiology and antimicrobial susceptibility patterns of burn wound cultures is critical for the management of burn wound infections. Our center has published previous results with Klebsiella species proved to be the most common species in burn wounds[10] and Pseudomonas aeruginosa in intensive care unit.[11] The identification of the causative microorganisms and their antibiotic resistance profiles can aid in the selection of appropriate empirical and targeted therapy,[12] reducing the risk of treatment failure and the spread of antibiotic-resistant bacteria. In addition, the use of topical antimicrobial agents[13] and proper wound care practices can also play a crucial role in preventing and managing burn wound infections.[14,15]

The rationale of this study is to identify the microbiology and susceptibility patterns of wound culture of burn patients. In order to provide effective empiric therapy to newly admitted burn patients.

Methodology

This is a retrospective observational study conducted over eight months starting from 1st June 2022 to 31st January 2023.

Patients admitted in the burn unit, with all ages, both genders and total burn surface areas (range from 1% to 80%), needing surgical management or ICU care or both, were included in this study. Patients with > 80% burns were excluded. Surgical management varied from; doing dressings (conservative management) to wound excision and skin grafting. ICU care is given to critical patients with more than 40% total burn surface area, face burns or any burn surface area along with inhalational injury or electric burn.

Culture and sensitivity reports of all those patients were organized who met the inclusion criteria.

Age, gender, mode of burn injury and total percentage of burns were entered in the patient database software named Hospital Information Management System (HIMS) used in our center.

We took a sterilized culture stick and touched swab part of it to the wound/pus thoroughly until it got wet with moisture/purulent discharge from the wound. Culture sticks were sent to the lab immediately after labeling.

Wound swabs were cultured on Blood, McConkey and Cysteine Lactose Electrolyte Deficient Agar media. Later isolates were cultured on MH agar media. In our institute we use MH agar or nutrient Agar once bacteria is isolated to check their susceptibility. To check sensitivity, we use Kirby Bauer method. In this method, bacteria are placed on a plate of solid growth medium, antibiotic dise are added to the plate and the bacteria allowed to grow overnight. Areas of dear media surrounding the disks indicate that the antibiotic has inhibited bacterial growth.

Results

A total of 1774 cases were found with a total burn surface areas ranging from 01-80% body surface.

Sixteen different kinds of organisms were found in 1774 samples. most common bacteria were Pseudomonas species in 828 (46.7%) cases, and Acinetobacter baumannii in 589 (33.2%) cases. Other bacteria included Klebsiella species in 120 (6.8%)cases, other Acinetobacter species in 93 (5.2%) cases, Proteus species in 37 (2.1%) cases, Staphylococcus aureus in 25 (1.4%) cases, Staphylococcus species (Coagulase negative) in 23 (1.3%) cases, other Gram negative bacilli in 21 (1.2%) cases , Enterobacter species in 16 (0.9%) cases, E.coli (MBL) in 14 (0.8%) cases, Plesiomonas species in 2 (0.1%) cases, Coliform species in 1(0.1%) case, Kluyvera Species in 1 (0.1%) case, Pseudomonas putida in 1 (0.1%) case, and least common were Streptococcus species in 1 (0.1%)case. Candida species was reidentified in 2 (0.1%) cases

Acinetobacter baumannii and other Acinetobacter species were found in a total of 682 (n) samples and combined make a 38.4% of total cases.

The most promising drugs showing sensitivity towards these organisms was Colistin which was checked against 1000 organisms and proved to be sensitive against 911 (94.1%) organisms, followed by Meropenem which was checked against 1160 and proved to be sensitive against 557 (49.5%).

Table 2 gives a detailed description of the effective-

Table 1: *Prevalence of microorganism in Wounds swabs of burn patients.*

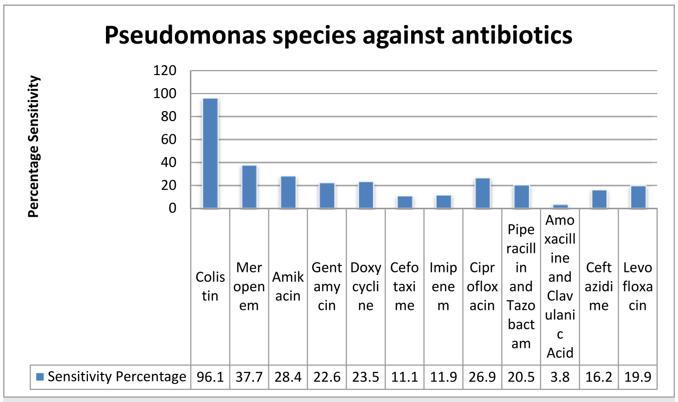
Name of Bacteria/Organism	Frequency	Percent
Pseudomonas species	828	46.7
Acinetobacter baumannii	589	33.2
Klebsiella species	120	6.8
Acinetobacter species	93	5.2
Proteus species	37	2.1
Staphylococcus aureus	25	1.4
Staphylococcus species (Coagulase negative)	23	1.3
Gram negative bacilli	21	1.2
Enterobacter species	16	.9
E.coli (MBL)	14	.8
Candida species(Non albicans)	2	0.1
Plesiomonas species	2	0.1
Coliform species	1	0.1
Kluyvera Species	1	0.1
Pseudomonas putida	1	0.1
Streptococcus species	1	0.1
Total	1774	100.0

Table 2: *Sensitivity of four most common organisms found in this study against several antibiotic preparations*

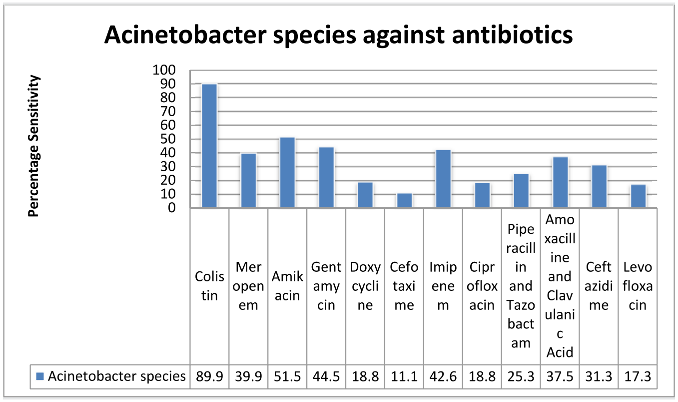
		Resistant (n)	Sensitive (n)	Total (n)	Percentage of Sensitivity %)
		Colistin		Total	
Bacteria	Pseudomonas species	23	570	593	96.1
	Klebsiella species	4	86	90	95.5
	Acinetobacter species	0	47	47	100
	Acinetobacter baumannii	32	238	270	88.1
Total		59	941	1000	94.1
		Meropenem		Total	
Bacteria	Pseudomonas species	373	226	599	37.7
	Klebsiella species	25	23	48	47.9
	Acinetobacter species	48	37	85	43.5
	Acinetobacter baumannii	157	271	428	63.3
Total		603	557	1160	48.0
		Amikacin		Total	
Bacteria	Pseudomonas species	430	171	601	28.4
	Klebsiella species	33	27	60	45
	Acinetobacter species	58	24	82	29.2
	Acinetobacter baumannii	178	227	405	56.0
Total		699	449	1148	39.1
		Gentamycin		Total	
Bacteria	Pseudomonas species	452	132	584	22.6
	Klebsiella species	33	25	58	43.1
	Acinetobacter species	54	21	75	28
	Acinetobacter baumannii	214	194	408	47.5
Total		753	372	1125	33.0
		Ceftriaxone		Total	
Bacteria	Pseudomonas species	10	2	12	16.6
	Klebsiella species	31	8	39	20.5
	Acinetobacter species	64	14	78	17.9
	Acinetobacter baumannii	193	126	319	39.4
Total		298	150	448	33.4
		Doxycycline		Total	
Bacteria	Pseudomonas species	13	4	17	23.5
	Klebsiella species	18	11	29	37.9
	Acinetobacter species	62	9	71	12.6
	Acinetobacter baumannii	337	173	510	33.
Total		430	197	627	31.4
		Cefotaxime		Total	
Bacteria	Pseudomonas species	8	1	9	11.1
	Klebsiella species	24	9	33	27.2
	Acinetobacter species	30	8	38	21.0
	Acinetobacter baumannii	169	72	241	29.8
Total		231	90	321	28.0
		Imipenem		Total	
Bacteria	Pseudomonas species	524	71	595	11.9
	Klebsiella species	31	15	46	32.6
	Acinetobacter species	53	21	74	28.3
	Acinetobacter baumannii	223	184	407	45.2
Total		831	291	1122	25.9
		Ciprofloxacin		Total	
Bacteria	Pseudomonas species	539	199	738	26.9
	Klebsiella species	72	25	97	25.7
	Acinetobacter species	68	12	80	15
	Acinetobacter baumannii	410	99	509	19.4
Total		1089	335	1424	23.5
		Piperacillin and Tazobactam		Total	
Bacteria	Pseudomonas species	499	129	628	20.5
	Klebsiella species	48	13	61	21.3
	Acinetobacter species	48	26	74	35.1
	Acinetobacter baumannii	282	86	368	23.3
Total		877	254	1131	22.4
		Amoxaciline and Clavulanic Acid		Total	
Bacteria	Pseudomonas species	100	4	104	3.8
	Klebsiella species	66	12	78	15.3
	Acinetobacter species	2	0	2	0
	Acinetobacter baumannii	43	27	70	38.
Total		211	43	254	16.9
		Ceftazidime		Total	
Bacteria	Pseudomonas species	371	72	443	16.2
	Klebsiella species	2	0	2	0
	Acinetobacter species	2	2	4	50
	Acinetobacter baumannii	86	38	124	30.
Total		461	112	573	19.5
		Levofloxacin		Total	
Bacteria	Pseudomonas species	527	131	658	19.9
	Klebsiella species	52	10	62	16.1
	Acinetobacter species	70	10	80	12.5
	Acinetobacter baumannii	375	83	458	18.1
Total		1024	234	1258	18.6

ness of all the antibiotics checked in this study.

Graphs 1 and 2 show the antibiotic susceptibility pattern of pseudomonas species & Acinetobacter species, 2 of the most common organisms isolated in our cultures.



Graph 1: *Sensitivity bar chart of Pseudomonas species against various antibiotics*



Graph 2: *Sensitivity bar chart of Acinetobacter species against various antibiotics*

Discussion

The most common pathogens were gram negative bacteria, most common being Pseudomonas species, unlike our previous study in which Klebsiella species were most common organisms[8,10]. Our study clearly shows that prevalence of gram positive bacteria is not commonly seen compared to other studies in similar patients at other centers[1]. Acinetobacter baumannii and other species of Acinetobacter are emerging as a big challenge in management of burn patients. Organism is notorious for growing on flat surfaces and making biofilms.[16]

Colistin is still the most potent antibiotic against these gram negative bacteria but with the passage of time the resistance against this antibiotic has also been observed. The total number of samples resistant to Colistin is 70 (n) out of total 1037 samples checked against it, which is 6.8%. Emergence of resistance to Colistin will bring new challenges in the coming years. Colistin is a last resort antibiotic used for treating infections caused by resistant bacteria. The emergence of Colistin resistance has limited our treatment options for life threatening infections. The development of new antibiotics and better infection control measures are necessary to curb the spread of Colistin resistance. Unfortunately Acinetobacter species have become most resistant against Colistin. We found 32 (10.1%) samples of Acinetobacter species resistant against Colistin. Also the Acinetobacter has become a huge challenge as it is found in 682 cases which was not found resistant to drugs like Colistin in previous study[5,10].

The second most potent antibiotic is Meropenem which is not even sensitive to 50% of samples included in this study, total number of samples resistant to it are (603 out of 1160) samples checked against it, so a 52% samples were resistant to this antibiotic. Amikacin is often considered as a good choice in absence and or during waiting period of culture sensitivity reports.[17] In our center, it has shown resistance to 699 (n) samples out of 1148 samples checked against it, which shows 59.9% resistance to samples.

Conclusion

Pseudomonas species were most common organism isolates in our study, followed by Klebsiella and Acinitobacter, and Colistin remains the most potent antibiotic against bacteria in our study followed by Meropenem.

Conflict of interest *None*

Funding Source *None*

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