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A comparative study on safety and effectiveness of a broad-spectrum antibiotics and narrow-spectrum antibiotics in skin and soft tissue infections

RakeshVanam[1] Itta Veronica Angelina[1],Dr.Swathi Boddupally[1*],
P.Haritha[2],R.Sandhya[2], Sravya Kanukanti[3], Sowmya Kompelli[3].
[1] Department of Pharm D, Bharat School of Pharmacy, Mangalpally, Ibrahimpatnam, Hyderabad-501510.
[1] Assistant Professor, Bharat School of Pharmacy, Mangalpally, Ibrahimpatnam, Hyderabad*
[2] Assistant Professor, Bharat School of Pharmacy, Mangalpally, Ibrahimpatnam, Hyderabad
[3]Department of Pharm D, Bharat School of Pharmacy, Mangalpally, Ibrahimpatnam, Hyderabad-501510.

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I. INTRODUCTION

Skin and soft tissue infections (SSTIs) are the third most common diagnosis in emergency rooms, behind chest discomfort and asthma. The skin is invaded and occupied by a great variety of microorganisms most of which live together with their hosts.Beta haemolytic streptococcus and methicillin-resistant staphylococcus aureus are the most common infection-causing pathogens[1].SSTIs have a wide range of symptoms, making assessing their frequency and prevalence difficult. SSTIs have a reported incidence rate of 24.6 per 1000 person-years. Because the majority of SSTIs resolve in seven to ten days, a prevalence estimate is highly variable. SSTIs are thought to be present in 7 percent to 10% of hospitalized individuals. SSTIs play a larger role among all hospitalized patients with infections exclusively. Men (60 percent to 70 percent of all cases) and patients between 45 and 64 years of age have a higher prevalence. Outpatient treatment is used in roughly 70% to 75% of all cases, with many SSTIs affecting the lower leg.[2] Various types of SSTIs which reported commonly are cellulitis, epidermoid cyst, skin abscess, diabetic foot infection.

Broad-Spectrum antibiotics includes Augmentin(Amoxicillin + Clavulanate), Ceftriaxone, Cefoperazone, whereas Narrow spectrum antibiotics includes Clindamycin and Cephalexin.Broad-spectrum antibiotics can be used empirically act against a wide spectrum of bacteria and are used also for drug-resistant bacteria. They find it helpful when the drug-resistant bacteria do not respond to other drugs. And the main disadvantage of broad-spectrum antibiotics is they develop resistance to bacteria[3]. Narrow spectrum antibiotic limited to inhibiting or killing the specific species of bacteria only. Narrow spectrum antibiotics are used only when the pathogen of the disease is known. Ability to cause superinfections is a little less in this case. The occurrence of resistance to the drug may develop directly by the bacteria as it develops chromosomal-based mutations in treatment. So, narrow-spectrum antibiotics have very less chances of developing bacterial resistance in the organism as they act only on specific bacteria[4]. Minor surgical interventions are Fasciotomy, debridement, excision, incision and drainage. Amoxicillin competitively inhibit penicillin binding proteins, leading to upregulation of autolytic enzymes and inhibition of cell wall synthesis[5].Ceftriaxone works by inhibiting the mucopeptide synthesis in the bacterial cell wall. The beta-lactam moiety of ceftriaxone binds to carboxypeptidases, endopeptidases and transpeptidases in the bacterial cytoplasmic membrane. These enzymes are involved in cell wall synthesis and cell division[5].Cefoperazone attaches to specific penicillin-binding proteins located inside the bacterial cell wall and suppresses the 3rd and last stage of bacterial cell wall development. The cells are then destroyed using autolysins, which are bacterial cell wall autolytic enzymes[5].Clindamycin is a bacteriostatic drug that acts by binding to 23S RNA of the 50s subunits of ribosome to inhibit the protein synthesis of bacteria. It impedes both the assembly of the ribosome and the translation process[5]. Cephalexin is a cephalosporin a bactericidal agent that acts by inhibiting cell-wall synthesis in bacteria leading to breakdown and eventually cell death[5].

II. METHODOLOGY

Materials and methods

For the present study, approval of the Institutional Ethics Committee, Durgabai Deshmukh Hospital (Registration No. ECR/477/Inst/AP/2013/RR-20) was taken. A cross-sectional study was conducted for 6 months in the Department of General Surgery at Durgabai Deshmukh Hospital, a 300-bed multi-speciality hospital.

The purpose of this study is to compare the broad-spectrum antibiotics and narrowspectrum antibiotics in the treatment of skin and soft tissue infections and to obtain knowledge of antibiotic usage. Demographic data was gathered from the patient's case report. Patients presenting with soft skin and tissue infections of either sex.Patients with the age group of less than 20 and patients with age more than 70, pregnancy and lactating women, patients not willing to study were excluded from the study.

All characteristics have been descriptively summarized. The mean values have been measured using Microsoft Excel. Numbers and percentages were used in the data summaries for categorical data. Data analysis was conducted using the Z-test. The results obtained were presented using various presenting methods for easier understanding. [9]

III. Results & Discussion

Table 1: Mean values of broad spectrum and narrow spectrum antibiotics.

Parameter	TLC count before treatment	TLC count after treatment	Number of days to recover
Broad spectrum antibiotics	11593.87097	5980.967742	6.129032258
Narrow spectrum antibiotics	14078.57143	9391.904762	6.142857143

Table 2: Z-TestTwo Sample for Means of Number of days for recovery with Broad and narrow spectrum antibiotics.

	Broad Spectrum	Narrow spectrum
Mean	6.129032258	6.142857143
Known Variance	5.78	3.32
Observations	31	21
Hypothesized Mean Difference	0	
Z	-0.02355252	
P(Z<=z) one-tail	0.490604773	
z Critical one-tail	1.644853627	
P(Z<=z) two-tail	0.981209545	
z Critical two-tail	1.959963985	

H_0: There is no significant difference between hormonal and non-hormonal therapy.
H_1: There is significant difference between hormonal and non-hormonal therapy.
Z calculated value= -0.023
Z critical value= 1.9599
The above table shows that there is no statistical difference between broad-spectrum and narrow spectrum antibiotics with respect to age because Z calculated value (-0.023) is smaller than Z critical value (1.9599).

Table 3: Z-TestTwo Sample for Means of TLC count before treatment with broad spectrum and narrow spectrum antibiotics.

	Broad Spectrum	Narrow spectrum
Mean	11593.87097	14078.57143
Known Variance	7607765	5797146
Observations	31	21
Hypothesized Mean Difference	0	
Z	-3.440811634	
P(Z<=z) one-tail	0.000289986	

z Critical one-tail	1.644853627	
P(Z<=z) two-tail	0.000579972	
z Critical two-tail	1.959963985	

H_0: There is no significant difference between hormonal and non-hormonal therapy.
H_1: There is significant difference between hormonal and non-hormonal therapy.
Z calculated value= -3.44
Z critical value= 1.9599
The above table shows that there is no statistical difference between broad-spectrum and narrow spectrum antibiotics with respect to age because Z calculated value (-3.44) is smaller than Z critical value (1.9599).

Table 4: Z-Test of Two Sample forMeans of TLC values after treatment with broad spectrum and narrow spectrum antibiotics.

	Broad spectrum	Narrow spectrum
Mean	5980.967742	9391.904762
Known Variance	5477162	8169276
Observations	31	21
Hypothesized Mean Difference	0	
Z	-4.53505155	
P(Z<=z) one-tail	2.87947E-06	
z Critical one-tail	1.644853627	
P(Z<=z) two-tail	5.75894E-06	
z Critical two-tail	1.959963985	

H_0: There is no significant difference between hormonal and non-hormonal therapy.
H_1: There is significant difference between hormonal and non-hormonal therapy.
Z calculated value= -4.535
Z critical value= 1.9599
The above table shows that there is no statistical difference between broad-spectrum and narrow spectrum antibiotics with respect to age because Z calculated value (-4.535) is smaller than Z critical value (1.9599).

Result: The above table shows there is no significant difference between broad spectrum and narrow spectrum antibiotics as both are effective in treating skin and soft tissue infections.
Discussion
In our study, a total number of 52 case reports with 29 male and 23 female with age group between 20-70 years were analysed and included during the study after considering exclusion and inclusion criteria.
Educational status received from patients classified as literate 30(57.69%), illiterate 22 (42.3%). Habitual history showed smoker 23(44.23%), non-smoker 29 (55.76%), alcoholics 31(59.61%), non-alcoholic 21(40.38%).
Hba1c values collected and classified patients under normal range 20 (38.4%), pre diabetes 12 (23.07%), diabetes 20 (38.4%).
The type of infections collected and classified as per out of 52 case reports, abscess 16(30.1%), cellulitis 15 (28.3%), sebaceous cyst 16(30.1%), diabetic foot 5(9.4%).
Total leukocyte count values after treatment with broad spectrum antibiotics showed mean 5980.9677. Total leukocyte count values after treatment with narrow spectrum antibiotics along with minimal surgical intervention if needed showed mean 8972.8571.
Number of days to cure the infection when patients treated with broad spectrum antibiotics with mean value 6.129032258. Number of days to recovery when patients treated with narrow spectrum antibiotics with minimal surgical intervention if needed with mean value 6.142857143.

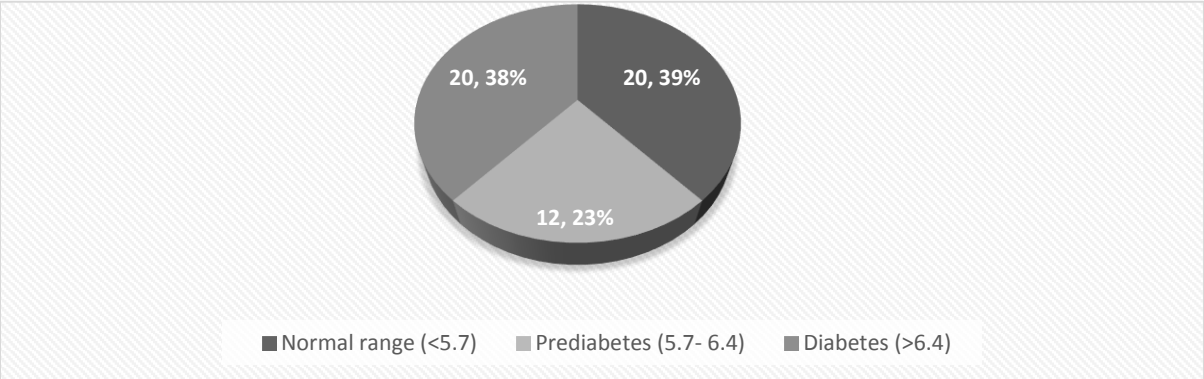
IV. Conclusion

Based on our observations, broad- spectrum antibiotics are effective in treating infections effectively. By Taking bacterial culture sensitivity test reports, TLC values, number of days to recovery into consideration narrow spectrum antibiotics can also be prescribed for the infections with minimal surgical interventions if needed.

Table: 5 Demographics data & patient characteristics in general surgery department			
Parameters	Age group	Number of Prescription	Percentage (%)
Age	20- 30	03	5.7%
	30- 40	12	23.07%
	40- 50	12	23.07%
	50- 60	12	23.07%
	60- 70	13	25%
	Total	Mean	49.9

Table: 6 Demographics data & patient characteristics in general surgery department			
Parameters	Gender variation	Number of Prescription	Percentage (%)
Gender variation	Male	29	55.7%
	Female	23	44.23%
	Total	52	

Table :7 Type of infections from case reports in general surgery department			
Parameters	Type of infection	Number of Patients	Percentage (%)
Type of infection	Abscess	16	30.1%
	Cellulitis	15	28.3%
	Sebaceous cyst	16	30.1%
	Diabetic foot	05	9.4%
	Total	52	



Pie chart 1: HBA1C values from all patients in General Surgery Department.

Table 8: TLC value before the starting of treatment with broad and narrow spectrum antibiotics:

S.no	Broad spectrum antibiotics	Narrow spectrum antibiotics
1	11600	10500
2	9500	14500
3	9600	11000
4	10500	14600
5	11200	11900
6	9500	15000
7	8500	16500
8	9000	16300
9	11350	14000
10	16500	15800
11	10700	12600
12	13000	14200
13	9800	15000
14	12060	13500
15	10200	18500
16	19500	11350

17	15600	15000
18	8500	18000
19	11800	11300
20	11500	10100
21	12500	16000
22	10800	
23	9900	
24	10900	
25	10500	
26	11400	
27	18000	
28	15900	
29	8500	
30	10600	
31	10500	

Table 9: TLC value after treatment with broad and narrow spectrum antibiotics:

S.no	Broad-spectrum antibiotics	Narrow spectrum antibiotics
1	5500	6500
2	3200	12600
3	4500	8500
4	4600	9500
5	3800	6500
6	4600	10500
7	3600	11300
8	4100	11500
9	8500	9500
10	12500	12500
11	6200	11500
12	4900	9530
13	4200	6500
14	5260	10600
15	4680	10000
16	9560	4900
17	6500	11000
18	4200	15600
19	4100	4800
20	8500	5000
21	6500	8900
22	7580	
23	4960	
24	4230	
25	6520	
26	7800	
27	8560	
28	11500	
29	4000	
30	4260	
31	6500	

Table 10: Number of days to cure the infection with broad spectrum and narrow spectrum antibiotics:

S.no	Broad-spectrum antibiotics	Narrow spectrum antibiotics
1	6	6
2	5	4
3	4	5
4	3	6
5	6	5
6	4	5
7	6	6
8	3	5
9	5	5
10	3	5
11	5	5
12	8	10
13	3	6
14	10	5
15	9	5
16	10	6
17	5	10
18	3	7

19	5	5
20	6	8
21	6	10
22	5	
23	5	
24	10	
25	6	
26	6	
27	10	
28	8	
29	5	
30	10	
31	10	

***CONFLICT OF INTEREST*:**
The authors have no conflicts of interest regarding this investigation**.**

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