

## Pattern of Infection and Bacterial Susceptibility of the Bacteria That Cause Skin and Soft Tissue Infections to Penicillin-G, Amoxicillin and Ampicillin

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**Abstract:** Skin and soft tissue infections (SSTIs) are among the most common infections. SSTIs may be caused by a wide range of pathogens. Antibiotic resistance especially in the developing countries is a growing concern, so we planned to study the pattern of infection and bacterial resistances of the bacteria that cause SSTI. The most prevalent bacterial isolate was *staphylococcus aureus* followed by beta hemolytic *Streptococcus*. The overall bacterial susceptibility of the 98 isolates showed that 8.1, 6.1, 85.8% were sensitive, intermediate and resistant respectively to penicillin-G. Our results indicated growth of antibiotic resistance of bacteria that cause SSTI to penicillin-G, amoxicillin and ampicillin regarding penicillin-G and amoxicillin compared to previous records. Strategies like treatment after getting antibiogram results and combined treatment seem to be necessary in treatment of SSTIs.

**Key words:** Antimicrobial • Bacteria • Resistance • Abscess

### INTRODUCTION

Skin and soft tissue infections (SSTIs) reflect inflammatory microbial invasion of the epidermis, dermis and subcutaneous tissues. They are common infections suffered by everyone at some point even with variable degrees [1]. SSTIs including diabetic foot infections, surgical wound infection, cellulitis and different kinds of abscesses are important because they cause a great deal of mortality and morbidity [2].

SSTIs may be caused by a wide range of pathogens, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Enterococcus* spp., *Klebsiella* spp. and *Enterobacter* spp. [4]. It is usually treated with topical antibiotics and oral antibiotics like cephalosporins. But if they become complicated, i.e. contamination of deeper tissues or comorbid diseases of the patients like diabetes mellitus, intravenous antibiotics or surgery may be necessary [3].

Antibiotic resistance especially in the developing countries is a growing concern and should be controlled [5]. In our hospital settings, there are reports of high antibiotic resistance and lots of antibiotics have become useless [5-11].

Successful SSTIs treatment begins with a proper antibiotic or a combination of antibiotics selection [12]. Moreover, this will eradicate the bacterial agents completely and reduce antibiotic resistance development [13]. We planned to study the SSTI pattern of infection and their antimicrobial resistances in the patients that are referred to Shahidbeheshti clinic of infectious diseases.

### MATERIALS AND METHODS

In this retrospective study, by referring to the Shahidbeheshti Hospital laboratory, data of SSTI samples including sex, age, type of bacterial growth and antibiotic susceptibility to penicillin-G, amoxicillin and ampicillin of every case [14] has been added to checklists

and all data were analyzed with SPSS software version 11.5. Names of the patients remained unrevealed. Antimicrobial susceptibility was evaluated by the Kirby-Bauer disk diffusion method in guidelines of Clinical and Laboratory Standards Institute [15].

## RESULTS

Data of 98 patients entered our checklists. There were 47 (48%) male patients and 51 (52%) female ones. Mean age of the patients was 59.3 years. Distribution of different bacterial types showed in the Figure 1.

The overall bacterial susceptibility of the 98 growth shows that only 8(8.1%) of them were sensitive to penicillin-G, 6(6.1%) were intermediate and 84(85.8%) were resistant. There results regarding amoxicillin were 18(18.3%), 22(22.4%) and 58(59.3%) for sensitive, intermediate and resistant species respectively. Antibiotic susceptibility pattern of ampicillin was 14(14.2%), 23(23.4%) and 61(62.4%) for sensitive, intermediate and resistant species respectively. Distribution of different bacterial type susceptibility pattern to the tested antibiotics can be seen in Figure 2-4 and resistance rate of different bacterial types can be seen in Table 1.

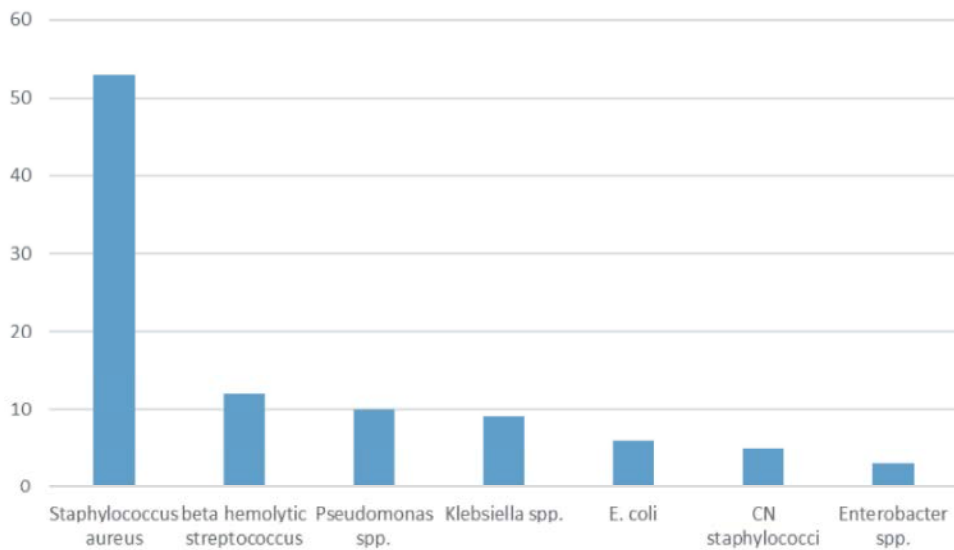


Fig. 1: Distribution of different bacterial types in patients with SSTIs

CN *Staphylococci*= coagulase-negative *Staphylococci*

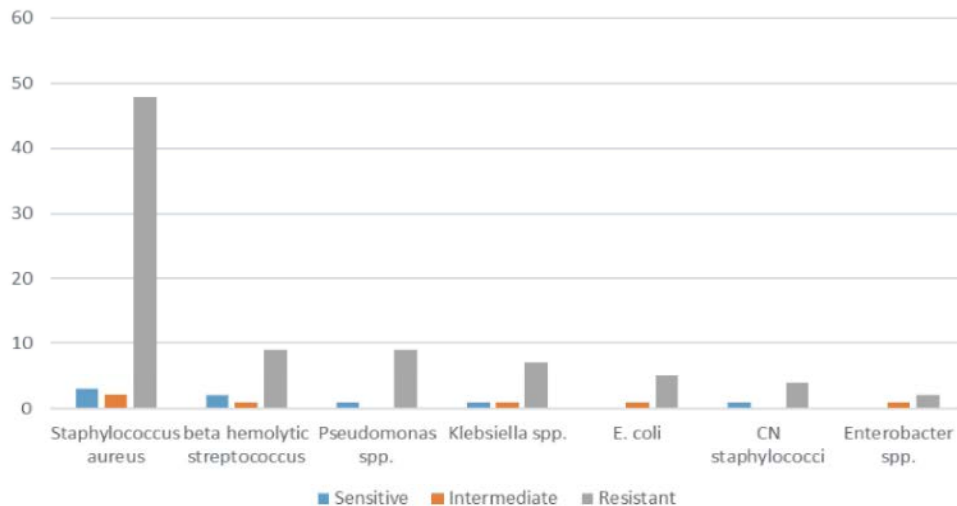


Fig. 2: Distribution of different bacterial type susceptibility pattern to penicillin-G in patients with SSTIs. CN

*Staphylococci*= coagulase-negative *Staphylococci*

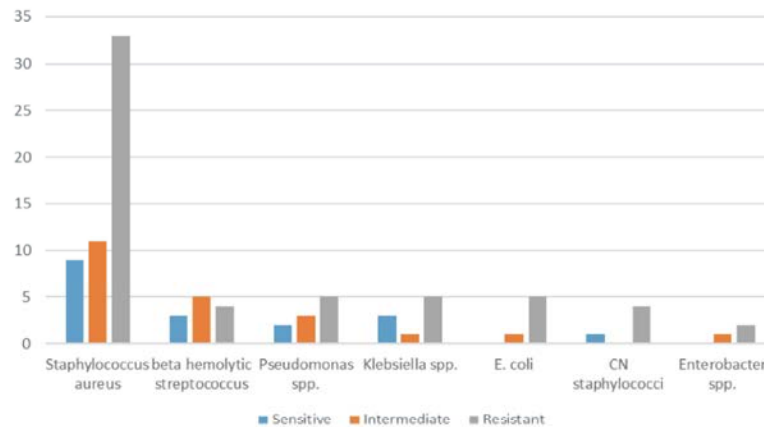


Fig. 3: Distribution of different bacterial type susceptibility pattern to amoxicillin in patients with SSTIs CN *Staphylococci*= coagulase-negative *Staphylococci*

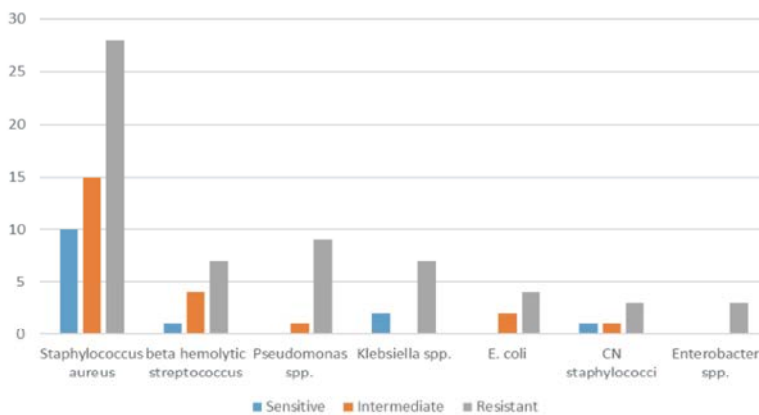


Fig. 4: Distribution of different bacterial type susceptibility pattern to ampicillin in patients with SSTIs CN *Staphylococci*= coagulase-negative *Staphylococci*

Table 1: Resistance rate (%) of different bacterial types to penicillin, amoxicillin and ampicillin in patients with SSTIs

Bacterial type	Penicillin-G	Amoxicillin	Ampicillin
<i>Staphylococcus aureus</i>	90.5	62.2	52.8
Beta hemolytic <i>Streptococcus</i>	75	33.3	58.3
<i>Pseudomonas</i> spp.	90	50	90
<i>Klebsiella</i> spp.	77	55.5	77.7
<i>E. coli</i>	83.3	83.3	66.6
CN <i>Staphylococci</i>	80	80	60
<i>Enterobacter</i> spp.	66.6	66.6	100
Overall	85.8	59.3	62.4

Table 2: Comparison of the results of different species susceptibility pattern of bacteria causing SSTI in the present study and the study of Sepehri *et al.* [19]

Bacterial type	Present study			Sepehri <i>et al.</i> study		
	P	Amo.	Amp	P	Amo.	Amp
<i>Staphylococcus aureus</i>	90.5	62.2	52.8	95.1	86	95.2
Beta hemolytic <i>Streptococcus</i>	75	33.3	58.3	83.3	71.4	71.4
<i>Pseudomonas</i> spp.	90	50	90	100	90.9	90
<i>Klebsiella</i> spp.	77	55.5	77.7	-	-	-
<i>E. coli</i>	83.3	83.3	66.6	100	100	66.7
CN <i>Staphylococci</i>	80	80	60	-	-	-
<i>Enterobacter</i> spp.	66.6	66.6	100	-	-	-

CN *Staphylococci*= coagulase-negative *Staphylococci*

## DISCUSSION

This study evaluated the data of 98 bacterial growths from the patients suffered from SSTI referred to Shahidbeheshti clinic of infectious diseases and analyzed their antimicrobial resistance patterns to penicillin-G, amoxicillin and ampicillin.

The most prevalent bacterial growth was *staphylococcus aureus* followed by beta hemolytic *Streptococcus*. The overall resistance to penicillin-G, amoxicillin and ampicillin was 85.8, 59.3 and 62.4% respectively. *Staphylococcus aureus* reported resistance to penicillin-G was 4-7% in the study that conducted by Kimberlin *et al.* [16]. But Groppo *et al.* [17] announced that the resistance rate of *Staphylococcus aureus* to penicillin-G, amoxicillin and ampicillin was 60, 53.3 and 50% respectively. Our results are only near this study's ampicillin result and the results of other two antibiotics are much higher in our study. This may be because of much more tendency to use penicillin and amoxicillin in our hospital settings compared to ampicillin.

A study by Cengiz *et al.* [18] showed that antibiotic resistance of beta hemolytic *Streptococcus* were 24, 17 and 59% for penicillin-G, amoxicillin and ampicillin respectively. While our results are higher than these results regarding penicillin-G and amoxicillin but are in concordance with this study in ampicillin results. This may be because ampicillin usage in our hospital settings is very much lower than those two antibiotics.

Another study that conducted in Iran on antibiotic susceptibility of isolates that cause SSTI by Sepehri *et al.* [19] showed that the prevalence of different bacterial types that cause SSTI were 51.8, 12.7, 10, 8.2, 6.4, 6.4 and 6.4% for *Staphylococcus aureus*, beta hemolytic *Streptococcus*, *Pseudomonas* spp., *Klebsiella* spp., *E. coli*, CN *Staphylococci* and *Enterobacter* spp. respectively. The overall antibiotic resistance of these isolates to penicillin-G was 94%, for amoxicillin was 83.3% and 88.1% for ampicillin. Our results are near these results in penicillin-G resistance but lesser than these results regarding other two antibiotics. The results of comparing every species between these two studies can be found in table 2.

Our results of antibiotic resistance of bacteria that cause SSTI to penicillin-G, amoxicillin and ampicillin are very high especially regarding penicillin-G and amoxicillin compared to other studies and these antibiotics are somehow useless in some species because of near 100% resistance rates. Strategies like treatment after getting antibiogram results and combined treatment seem to be necessary in treatment of SSTIs.

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