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ANTIBIOGRAM OF STAPHYLOCOCCUS AUREUS FROM PUS SAMPLES IN A TERTIARY CARE HOSPITAL

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ABSTRACT

Staphylococcus aureus is amongst the most dangerous human pathogens, including bacteremia, pneumonia, osteomyelitis, meningitis, etc. The overuse of antibiotics and incompliance with the drug courses have resulted into antibiotic resistance amongst these microorganisms. Present study demonstrates the changing trends in antibiotic susceptibility amongst the Staphylococcus aureus species isolated from pus samples from various clinical units in a tertiary care hospital. A retrospective study was conducted for a period of 2 years for the isolation of S.aureus species. Various antibiotics were tested against S.aureus based on CLSI guidelines. A total of 275 S.aureus strains were isolated out of which 163 (59%) were Methicillin-resistant Staphylococcus aureus (MRSA). A rise in the occurrence of Methicillin-sensitive Staphylococcus aureus (MSSA) has also been observed with an increase in resistance to various antibiotics amongst them. S.aureus showed highest sensitivity to Vancomycin (30µg) followed by Gentamicin (10µg) and Cotrimoxazole (1.25/23.75 µg).

Introduction

Staphylococcus aureus is amongst the most dangerous human pathogens. They result into infections that are widespread in nature.1 S.aureus can cause severe infections, including bacteremia, pneumonia, osteomyelitis, acute endocarditis, myocarditis, pericarditis, cerebritis, meningitis, chorioamnionitis, and scalded skin syndrome.1,2 They can live harmlessly on the skin surfaces, but can lead to serious infections that may ultimately result into disease or even death. [3,4,5]

Antibiotics have been successful in treating Staphylococcal infections. The overuse of antibiotics and incompliance with the drug courses have resulted into antibiotic resistance.5 The changing pattern of resistance in S.aureus over the past decade, has underscored the need for new antimicrobial agents.[6]

The introduction of Methicillin in 1961 was rapidly followed by reports of methicillin resistance in S.aureus.6 There has been a dramatic increase in community-associated (CA) Staphylococcus aureus infections, mainly due to methicillin-resistant strains.7 Methicillin was first introduced in 1959 and was very effective in treating patients with penicillin-resistant Staphylococcus aureus infections. Two years later, in 1961, the first case of MRSA was reported.3,4 Staphylococcal infections are usually associated with people with compromised immune systems and who have had frequent or recent contact with hospitals or other long-term care facilities such as nursing homes and dialysis centers.3,5 It is commonly transmitted via the hands of health care workers and is associated with severe, invasive diseases in hospitalized patients.8 The importance of S.aureus in skin and soft tissue infections has long been appreciated since Alexander Ogston first unveiled the role of the pathogen in the etiology of pyogenic abscess in the late 19th century. Although a diversity of bacteria are currently implicated, S.aureus is amongst the most prominent cause of such infections.[9]

The present study was conducted to evaluate the changing trends in antibiotic susceptibility amongst the Staphylococcus aureus species isolated from pus samples in a tertiary care hospital.

Material and methods

This is a retrospective study conducted for 2 years from the month of November 2015 to October 2017. All the pus samples received during this period were screened by staining as well as culture. Amongst the various bacteria isolated, strains of S.aureus were identified and further subjected to antibiotic susceptibility testing by Kirby Bauer disk diffusion method. Based on CLSI guidelines, various antibiotics were tested against S.aureus which included Penicillin (10U), Erythromycin (15µg), Clindamycin (2µg), Ciprofloxacin (5µg), Cotrimoxazole (1.25/23.75 µg), Gentamicin (10µg), Vancomycin (30µg).

Results

A total of 3570 pus samples were obtained during 2 years, out of which 2420 samples revealed growth on culture. Most of the isolates obtained were Gram negative microorganisms. Of the Gram positive organisms isolated, 275 were Staphylococcus aureus as shown in table 1.

Table 1

Observations	Nov 2015-Oct 2016	Nov 2016-Oct 2017	TOTAL
Total no. of samples obtained	1586	1984	3570
No. of samples that revealed growth on culture	1232	1388	2420
No. of Staphylococcus aureus isolated	113	162	275

Samples obtained during the period Nov 2016-Oct 2017 were comparatively more than the previous year. A rise in culture positive samples was also observed. A significant rise in the number of S.aureus isolates was also noticed as shown in Table 2

Table 2

Observations	Nov 2015-Oct 2016	Nov 2016-Oct 2017
Total no. of S.aureus strains isolated out of total isolates	113	162
Percentage of S.aureus isolated	9.17%	11.67%

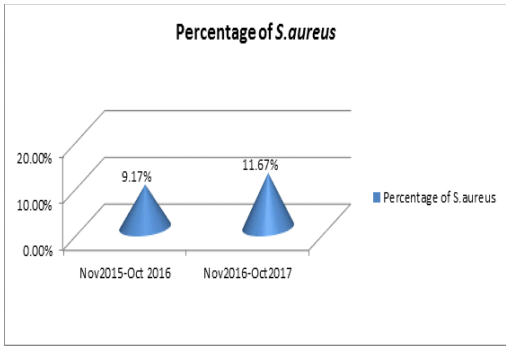

Chart 1: Yearly distribution of S.aureus isolates

These isolates were screened for Methicillin resistance using Cefoxitin antibiotic disk (30µg) as the surrogate marker. The results obtained after screening were as given in table 2 and table 3.

Out of the 275 S.aureus species isolated, 112 isolates were of Methicillin-sensitive Staphylococcus aureus while 163 isolates were of Methicillin-resistant Staphylococcus aureus.

Table 2

Observations	Number of isolates (n=275)	Percentage
Total no. of MSSA isolates	112	40.72%
Total no. of MRSA isolates	163	59.27%

Table 3

Observations	Nov 2015-Oct 2016	Nov 2016-Oct 2017
MSSA isolates (Percentage of MSSA)	42 (37.16%)	70 (43.20%)
MRSA isolates (Percentage of MRSA)	71 (62.83%)	92 (56.79%)

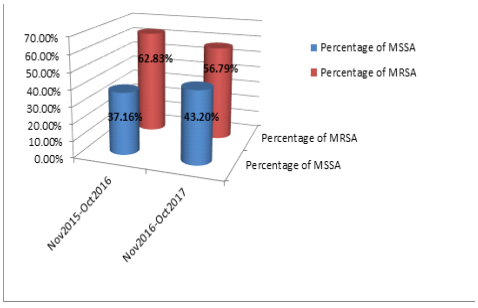

Chart 2: Yearly distribution of MRSA and MSSA isolates

As depicted in table 3, the percentage of MRSA isolates in the year 2015-16 were more as compared to that in the year 2016-17. A rise in the percentage of MSSA isolates has also been observed in the later year. From this table it can be interpreted that the occurrence of infections due to MSSA strains is increasing.

Antibiotic sensitivity pattern amongst the MSSA isolates showed observations as indicated in Table 4.

Table 4

Antibiotics	No. of sensitive MSSA isolates (n=112)	Percentage (%)
Penicillin	32	28.57
Erythromycin	66	58.92
Clindamycin	85	75.89
Cotrimoxazole	84	75.00
Ciprofloxacin	66	58.92
Gentamicin	103	91.96
Vancomycin	112	100

Chart 3: Percentage sensitivity of MSSA isolates to different antibiotics

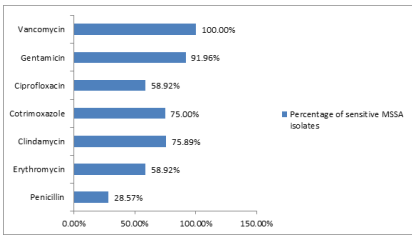

Table 5 shows the sensitivity pattern of MRSA isolates

Table 5

Antibiotics	No. of sensitive MRSA isolates (n=163)	Percentage (%)
Penicillin	8	4.90
Erythromycin	42	25.76
Clindamycin	65	39.87
Cotrimoxazole	71	43.55
Ciprofloxacin	34	20.85
Gentamicin	110	67.48
Vancomycin	156	95.70

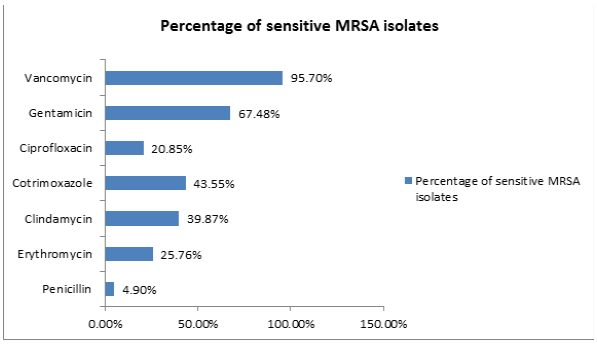

Chart 4: Percentage sensitivity of MRSA isolates to different antibiotics

Discussion

Staphylococcus aureus is capable of causing a variety of human infections, including fatal invasive and toxic conditions. It also possesses a differential ability to spread and cause hospital associated outbreaks of infection.10 Resistance to multiple antibiotics among the S.aureus isolates has been reported widely and has proved to be a major challenge in combating infections and in hospital infection control as well.11,12 Present study demonstrates a relative rise in the occurrence of MSSA isolates as compared to MRSA over a period of two years. An increase in the occurrence of multidrug resistant strains amongst MSSA isolates was also observed.

In present study, the sensitivity of MSSA isolates to antibiotics Penicillin (10U), Erythromycin (15µg), Clindamycin (2µg), Cotrimoxazole (1.25/23.75 µg), Ciprofloxacin (5µg), Gentamicin (10µg) and Vancomycin (30µg) was around 28%, 59%, 76%, 75%, 59%, 92% and 100% respectively. Similar sensitivity results for Gentamicin and Vancomycin were observed in studies conducted by Al-Zoubi MS et al.13 Approximately similar sensitivity to Gentamicin, Erythromycin and Penicillin was observed by Onwubiku and Sadiq.14 While Pandey S et al observed similar type of sensitivity to Cotrimoxazole.[15]

The percentage of MRSA isolated were about 59% in present study. Similar percentage was observed by Obajuluwa AF et al.16 While a slightly less percentage of MRSA was isolated in study conducted by Bukhari S et al.17 Sensitivity of MRSA to Penicillin (10U), Erythromycin (15µg), Clindamycin (2µg), Cotrimoxazole (1.25/23.75 µg), Ciprofloxacin (5µg), Gentamicin (10µg) and Vancomycin (30µg) was approximately 5%, 26%, 40%, 43%, 21%, 67% and 98% respectively. Similar results with Penicillin were obtained by Al-Zoubi MS et al.13 Gentamicin and Vancomycin sensitivity was similar in studies by Mandelia C et al, Brown D et al and Al-Zoubi MS et al.13,16,18 Ciprofloxacin sensitivity was similar in studies by Mandelia C et al and Bukhari S et al.17,18 Sensitivity to Cotrimoxazole was similar in studies conducted by Mandelia C et al, Al-Zoubi MS et al, while similar sensitivity to Erythromycin was observed by Kaleem F and Al-Zoubi MS et al.[13,18,19]

S.aureus has been implicated in hospital acquired infections. At

present, MRSA infections are treatable but it is important to prevent the spread of MRSA. An effective way to prevent such spread of S.aureus and MRSA in hospital settings is to screen health care takers for the presence of this organism.[20]

Conclusion

This study emphasizes the need for continuous monitoring of the antimicrobial susceptibility pattern of S.aureus isolates, MRSA as well as MSSA for the selection of appropriate therapy. In addition, regular surveillance of hospital associated infections and implementation of a strict drug policy for antibiotics is the need of time. Appropriate antimicrobials as well as their cost effectiveness need to be considered in drugs prescribed for staphylococcal infections. Good hospital infection control measures prove to be the main stay against these infections because antibiotics can never be an effective alternative to good medical practice.

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